Cottonwood Creek Ammonia Total Maximum Daily Load Review

FINAL

State of Idaho

Department of Environmental Quality

July 2021

Acknowledgments

DEQ thanks property owners for providing private property access, and the South Fork Clearwater Watershed Advisory Group for their time and input. DEQ also thanks Nez Perce Tribe Water Resources and Idaho Association of Soil Conservation Districts for their monitoring efforts; their monitoring data were very helpful for this TMDL review. Information provided by the City of Cottonwood helped DEQ monitoring efforts described in this document.

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Abbreviations, Acronyms, and Symbols

§ 303(d)	refers to section 303 subsection (d) of the Clean Water Act, or a list of impaired water bodies required by this section
µ	micro, one-one thousandth
§	section (usually a section of federal or state rules or statutes)
AU	assessment unit
BURP	Beneficial Use Reconnaissance Program
C	Celsius
CFR	Code of Federal Regulations (refers to citations in the federal administrative rules)
cfs	cubic feet per second
CWAL	cold water aquatic life
DEQ	Idaho Department of Environmental Quality
EPA	United States Environmental Protection Agency
HUC	hydrologic unit code
IASCD	Idaho Association of Soil Conservation Districts
IDAPA	Refers to citations of Idaho administrative rules
IPDES	Idaho Pollutant Discharge Elimination System
LA	load allocation
LC	load capacity
mi	mile
mg/L	milligrams per liter
MOS	margin of safety
NA	not assessed
NPDES	National Pollutant Discharge Elimination System
NPT	Nez Perce Tribe
NPTWR	Nez Perce Tribe Water Resources
QA	quality assurance
QC	quality control
SS	salmonid spawning
TAN	total ammonia nitrogen
TMDL	total maximum daily load
WAG	watershed advisory group
WBAG	Water Body Assessment Guidance
WLA	wasteload allocation
WWTP	waste water treatment plant

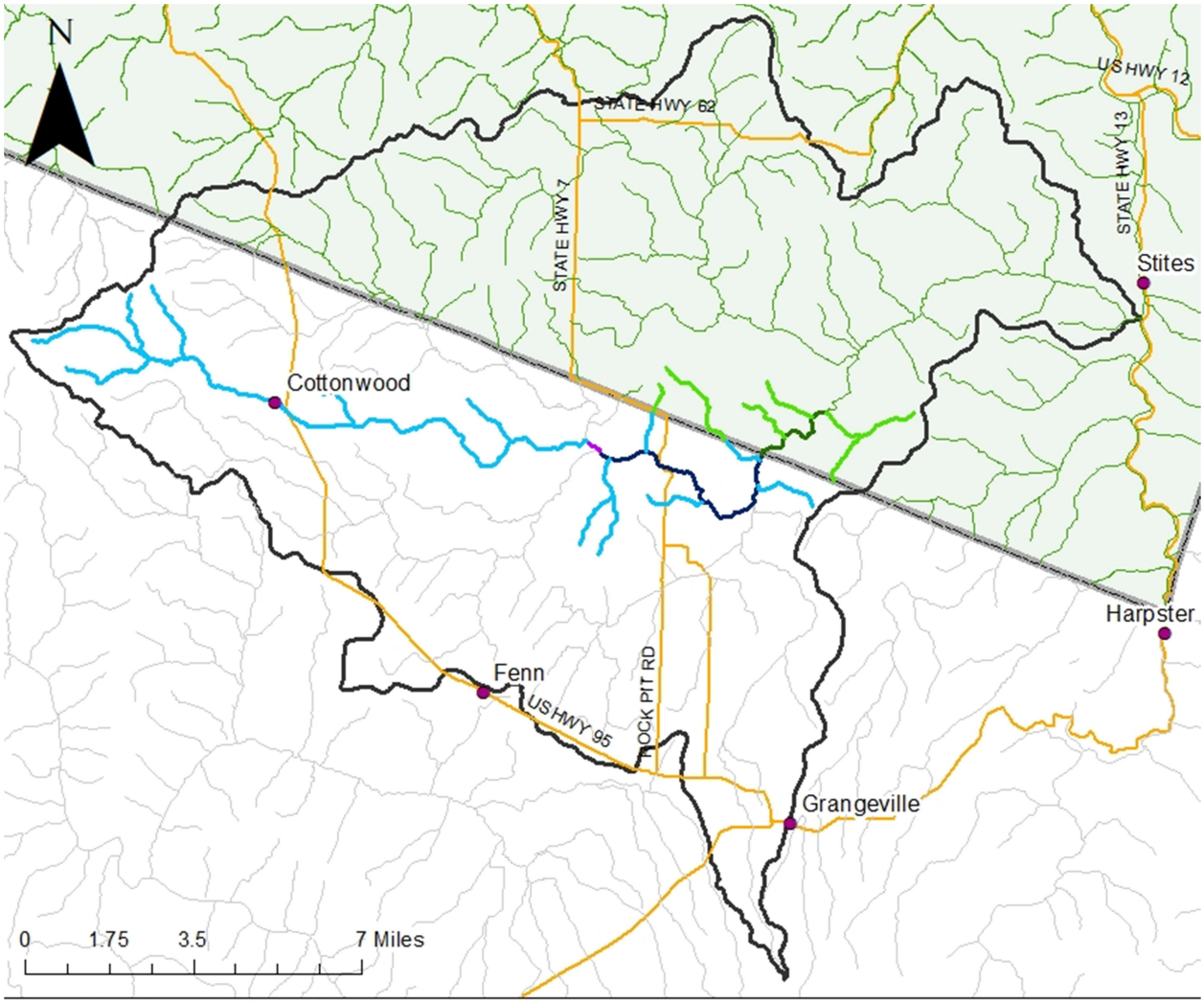
Executive Summary

This document presents a review of the Cottonwood Creek ammonia total maximum daily loads (TMDLs). It addresses streams that are impaired by ammonia under the Clean Water Act, in Category 4a of Idaho's 2018/2020 Integrated Report (DEQ, 2020), and outside the Nez Perce Reservation boundary. This review was developed to comply with Idaho Code § 39-3611(7). It describes current water quality status, pollutant sources, and recent pollution control efforts in the watershed.

Subbasin at a Glance

Cottonwood Creek is tributary to the South Fork Clearwater River located in Idaho County, ID (Figure A). Cottonwood Creek flows west to east approximately 30 miles from its headwaters to its mouth, where it joins the South Fork Clearwater River near Stites, ID, draining an area of 192 square miles. The main stem of Cottonwood Creek is the receiving water for the City of Cottonwood wastewater treatment plant (WWTP), which is permitted to discharge November through April into a second order segment of the creek. The lower 11 miles of 4th order Cottonwood Creek flow through the Nez Perce Tribe Reservation.

A detailed assessment of the watershed including watershed characterization, water quality, and pollutant sources can be found in the Cottonwood Creek Total Maximum Daily Load (DEQ, 2000). Additional information regarding physical and biological characteristics, geology, topography, and land use can be found in the South Fork Clearwater Subbasin assessment and Total Maximum Daily Loads (DEQ, 2004).



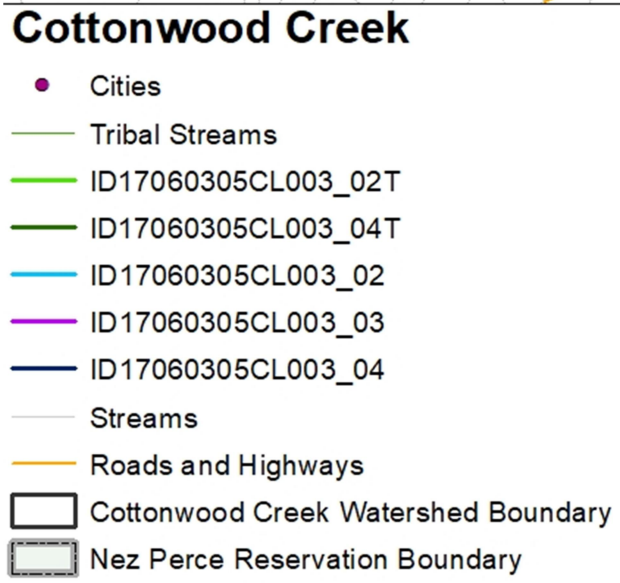


Figure A. Cottonwood Creek assessment units addressed in this TMDL review.

Key Findings

In 2000, the Idaho Department of Environmental Quality (DEQ), Nez Perce Tribe (NPT), and US Environmental Protection (EPA) agency determined ammonia concentrations in Cottonwood Creek exceeded Idaho's ammonia water quality criteria and impaired Cold Water Aquatic Life use (DEQ, 2000) based on 1996-1998 monitoring data. DEQ, NPT, and EPA jointly developed an ammonia total maximum daily load (TMDL) that identified the City of Cottonwood wastewater treatment plant (WWTP) as a significant ammonia source, and required the WWTP to decrease ammonia loading by 5% to meet Idaho's ammonia water quality criteria (DEQ 2000). The 2000 ammonia TMDL was developed at the watershed scale and addressed stream segments inside and outside the Nez Perce Reservation boundary.

For this TMDL review, DEQ gathered Cottonwood Creek water quality data collected by various agencies since 2000, and monitored Cottonwood Creek ammonia concentrations 2019-2021. Using these data, DEQ evaluated whether Cottonwood Creek ammonia concentrations exceed Idaho's current ammonia water quality criteria (IDAPA 58.01.02.250.02d), and compared concentrations upstream and downstream of the WWTP. During periods when the WWTP discharged effluent, ammonia concentrations exceeded the chronic criterion approximately 1 mile downstream of the WWTP, where Cottonwood Creek crosses Nuxoll Road. Ammonia concentrations did not exceed criteria downstream during periods when the WWTP did not discharge effluent, and did not exceed criteria upstream of the WWTP. These patterns indicate ammonia criteria are exceeded only downstream of the WWTP, and the WWTP is the only significant ammonia source to Cottonwood Creek. A summary of data, sampling sites, and results is presented in this review document and in Appendix B.

Table A. Existing ammonia total maximum daily loads (TMDLs) for Cottonwood Creek and general status.

Assessment Unit Name	Assessment Unit Number	Pollutant[a]	TMDL Approval Year	Water Quality Trend
Cottonwood Creek - source to Cottonwood Creek waterfall	ID17060305CL003_02	ammonia	2000	Static
Cottonwood Creek - source to Cottonwood Creek waterfall Tribal Water	ID17060305CL003_02T	ammonia	2000	Static
Cottonwood Creek - source to Cottonwood Creek waterfall	ID17060305CL003_03	ammonia	2000	Unknown
Cottonwood Creek - source to Cottonwood Creek waterfall	ID17060305CL003_04	ammonia	2000	Improving
Cottonwood Creek - source to Cottonwood Creek waterfall Tribal Water	ID17060305CL003_04T	ammonia	2000	Improving

a Ammonia as TAN = Total Ammonia Nitrogen

Changes in Subbasin

Since the Cottonwood Creek TMDL was finalized in 2000, there have been several administrative changes relevant to the TMDL. First, Idaho's ammonia water quality criteria changed in 2002; the criteria used to develop TMDL goals no longer apply. This TMDL review compared available ammonia monitoring results to Idaho's current criteria. Ammonia concentrations exceeded Idaho's current criteria downstream of the City of Cottonwood WWTP.

Second, the City of Cottonwood WWTP does not currently discharge under a permit that includes an ammonia effluent limit, but will in the near future. The City of Cottonwood currently discharges under a National Pollution Discharge Elimination System (NPDES) permit issued by EPA that does not include an ammonia effluent limit. In July 2018, EPA granted DEQ authority to regulate discharges from municipal WWTPs under the Idaho Pollution Discharge Elimination System (IPDES) program. Authority for administering the City of Cottonwood WWTP's existing NPDES permit transferred from USEPA to DEQ. In 2021, DEQ issued a draft IPDES discharge permit for the City of Cottonwood WWTP (permit No. ID0021849) that includes an ammonia effluent limit. The draft permit includes interim effluent limits that must be achieved while the City takes steps to improve its treatment system, and a final effluent limit based on Idaho's current ammonia criteria (IDAPA 58.01.02.250.02d) that must be achieved by 2028. At the time this TMDL review was written, DEQ had not yet finalized and issued the IPDES permit, so ammonia effluent limits are not yet in place.

Third, Idaho tribes and EPA requested that DEQ no longer assess or report water quality information for waters within reservation boundaries (see public comments in Idaho's 2002 Integrated Report [DEQ 2005]). In response, DEQ developed a tribal waters policy cooperatively with Idaho Indian tribes and EPA (DEQ 2018). DEQ now splits streams at EPA-recognized reservation boundaries. DEQ labels steam segments within reservation boundaries as tribal waters and places them in their own Integrated Report category (Category 3t) with all beneficial uses unassessed. The policy states DEQ will not sample, assess support of beneficial uses, or develop TMDLs for waters within tribal boundaries. Therefore, although the Cottonwood Creek ammonia TMDL addressed stream segments both inside and outside the reservation, DEQ no longer assesses or develops TMDLs for segments within the Nez Perce Reservation boundary. This TMDL review focuses primarily on stream segments outside the reservation boundaries. See section 1.5 for details.

Watershed land use has not changed substantially since the TMDL was finalized in 2000 (Table B). Several water quality improvement projects have been completed (Table C). Most of these projects helped agricultural producers implement agricultural best management practices. These projects likely helped reduce nutrient inputs to Cottonwood Creek. However, historic and recent monitoring data described in subsequent sections of this document suggest the City of Cottonwood WWTP is the primary ammonia source to Cottonwood Creek.

Table B. Comparison of land use patterns reported in the Cottonwood Creek TMDL (2000) to 2016 National Land Cover data. NA = category was not included in dataset.

Time Period	Cropland	Pasture / Grassland/ Range	Forestland	Urban /Industrial	Shrubland
TMDL (2000)	74%	20%	6%	<1%	NA
Current (2016)	72.8%	15.6%	4.6%	3.5%	3.4%

Table C. Inventory of water quality improvement projects in the Cottonwood Creek watershed since 2000.

Area	Category	Agency	Project Name	Years	Status	Focus BMPs	Pollutants Addressed				Cost	Funding Source(s)
							Sed	Bact	Nutr	Temp		
Cottonwood Cr	Ag & Livestock	Idaho SWCD	South Fork Cottonwood Creek BMP Implementations	2001–2003	complete	Residue management, nutrient management, livestock facilities	x	x	x	—	$286,159	CWA §319 grant
Cottonwood Cr	Ag & Livestock	Idaho SWCD	Cottonwood BMP Implementations	2001–2004	complete	Residue management, nutrient management, livestock facilities	x	x	x	—	$208,604	Idaho WQPA
Cottonwood Cr	Ag & Livestock	Idaho SWCD	Cottonwood Creek Restoration	2011–2014	complete	Residue management, nutrient management, livestock facilities	x	x	x	—	$311,396	Snake River Basin Adjudication
Cottonwood Cr	Ag & Livestock	Idaho SWCD	Cottonwood Phase 2 BMP Implementations (§319)	2003–2007	complete	Residue management, nutrient management, livestock facilities	x	x	x	—	$247,974	CWA §319 grant
Cottonwood Cr	Ag & Livestock	Idaho SWCD	Cottonwood Phase 2 BMP Implementations (WQPA)	2003–2011	complete	Residue management, nutrient management, livestock facilities	x	x	x	—	$200,000	Idaho WQPA
Red Rock Cr	Ag & Livestock	Idaho SWCD	Red Rock Creek Livestock BMP Implementations—Phase 2	2019–2022	ongoing	Livestock facilities	x	x	x	—	$177,684	CWA §319 grant
Red Rock Cr	Ag & Livestock	Idaho SWCD	Red Rock Creek AFO Implementation Project	2017–2018	complete	Livestock facilities	x	x	x	—	$128,237	State Ag Fund
Camas Prairie	Ag & Livestock	Idaho SWCD	Western Camas Prairie Culvert Replacement	2016–2018	complete	Sediment management	x	—	—	—	$184,925	CWA §319 grant

Area	Category	Agency	Project Name	Years	Status	Focus BMPs	Pollutants Addressed				Cost	Funding Source(s)
							Sed	Bact	Nutr	Temp		
Camas Prairie	Ag & Livestock	PCEI	South Fork Clearwater Watershed Vegetation	2010–2014	complete	Riparian vegetation, channel stabilization, drainage water management, wetland	x	x	x	x	$246,261	CWA §319 grant
Camas Prairie	Ag & Livestock	Latah SWCD	North Idaho Division II Animal Feeding Project	2002–2012	complete	Region-wide livestock project; subset of funds used locally	—	x	x	—	—	CWA §319 grant, Idaho WQPA
Camas Prairie	Ag & Livestock	Idaho SWCD	South Fork Clearwater River BMP Implementations	2007–2012	complete	Residue management, nutrient management, livestock facilities	x	x	x	—	$500,014	Idaho WQPA
Camas Prairie	Ag & Livestock	Idaho SWCD	South Fork Clearwater River BMP Implementations (§319)	2010–2013	complete	Residue management, nutrient management, livestock facilities	x	x	x	—	$250,000	CWA §319 grant

TMDL Analysis

A TMDL analysis was conducted based on requirements established in Idaho Code §39-3611(7). TMDL analyses must include an evaluation of the attainability of beneficial uses as described in §39-3607, and "an evaluation of the water quality criteria, instream targets, pollutant allocations, assumptions and analyses upon which the TMDL were based" (in Idaho Code §39-3611(7)). Table B summarizes outcomes of these required analyses, plus analysis of TMDL consistency with Idaho's tribal waters policy. DEQ will seek advice from the South Fork Clearwater Watershed Advisory Group and other stakeholders in public meetings to determine the best path forward.

Table D. Summary of TMDL review analyses and outcomes.

TMDL Review Component	Summary	TMDL Recommendation
Are beneficial uses the TMDL was developed to protect appropriate and attainable?	Yes. The Cottonwood Creek ammonia TMDL was developed to protect the Cold Water Aquatic Life beneficial use, and DEQ believes that use is attainable.	No TMDL changes are recommended.
Are the water quality criteria used in the TMDL consistent with current Idaho Water Quality Standards?	No. Idaho's ammonia water quality standard was revised in 2002.	No TMDL changes are recommended because updating the TMDL to use the current ammonia water quality standard would have no practical effect. The City of Cottonwood WWTP is the only significant ammonia source, so IPDES permit effluent limits and WWTP compliance with those limits control ammonia loading levels. The current draft IPDES permit effluent limit, and limits in future permits, will be based on Idaho's most current ammonia water quality standard, which is protective of Cold Water Aquatic Life use.
Are the TMDL targets appropriate?	No. Ammonia targets are based on the Idaho Ammonia water quality standard in place in 2000. The standard has been revised since then.	No TMDL changes are recommended. See above.
Are point source (wasteload) allocations appropriate?	No. Ammonia wasteload allocations are based on the Idaho Ammonia water quality standard in place in 2000. The standard has been revised since then.	No TMDL changes are recommended. See above.
Are load capacities appropriate?	No. Ammonia targets are based on the Idaho Ammonia water quality standard in place in 2000. The standard has been revised since then.	No TMDL changes are recommended. See above.
Are TMDL assumptions and analyses appropriate?	No. The WWTP appears to be the primary source; nonpoint sources appear insignificant.	No TMDL changes are recommended. See above.
Is the existing TMDL implementation plan adequate?	Yes	Achieving effluent limits should be the focus of implementation.
Is the TMDL consistent with Idaho's Tribal Waters Policy?	No	The TMDL was created before Idaho's tribal waters policy, and targets and loads are not specific to stream segments outside the reservation boundary.

Review of Beneficial Uses

The Cottonwood Creek ammonia TMDL was developed to protect the Cold Water Aquatic Life beneficial use, and DEQ believes that use is attainable. Recent ammonia monitoring

demonstrated that 4th order Cottonwood Creek (ID17060305CL003_04) is achieving ammonia criteria, which are protective of Cold Water Aquatic Life use. Third order Cottonwood Creek (ID17060305CL003_03) could not be evaluated due to lack of data. The 2nd order AU (ID17060305CL003_02) is not achieving criteria and therefore this segment of Cottonwood Creek does not currently support Cold Water Aquatic Life use.

Recommendations for Further Action

Recommended changes to the next Integrated Report are summarized in Table E below. The City of Cottonwood WWTP is the only significant source of ammonia to Cottonwood Creek. The ammonia effluent limit in the current draft IPDES permit and in future permits will be based on Idaho's most current ammonia criteria. Therefore, when WWTP effluent consistently meets permit limits, Idaho's ammonia water quality standard will be achieved in Cottonwood Creek, and therefore ammonia will no longer impair Cold Water Aquatic Life use.

Table E. Recommendations for Idaho's 2022 Integrated Report.

Assessment Unit Name	Assessment Unit Number	Recommended Changes to Next Integrated Report	Justification
Cottonwood Creek - source to Cottonwood Creek waterfall	ID17060305CL003_02	No change; retain in Category 4a	Does not achieve current ammonia criteria
Cottonwood Creek - source to Cottonwood Creek waterfall, Tribal Waters	ID17060305CL003_02T	No change; Category 3t, not assessed	DEQ Tribal Waters Policy
Cottonwood Creek - source to Cottonwood Creek waterfall	ID17060305CL003_03	No change; retain in Category 4a	No data available to evaluate ammonia concentrations
Cottonwood Creek - source to Cottonwood Creek waterfall	ID17060305CL003_04	Delist ammonia as cause of impairment	Meets current ammonia criteria
Cottonwood Creek - source to Cottonwood Creek waterfall, Tribal Waters	ID17060305CL003_04T	No change; Category 3t, not assessed	DEQ Tribal Waters Policy

TAN = Total Ammonia Nitrogen

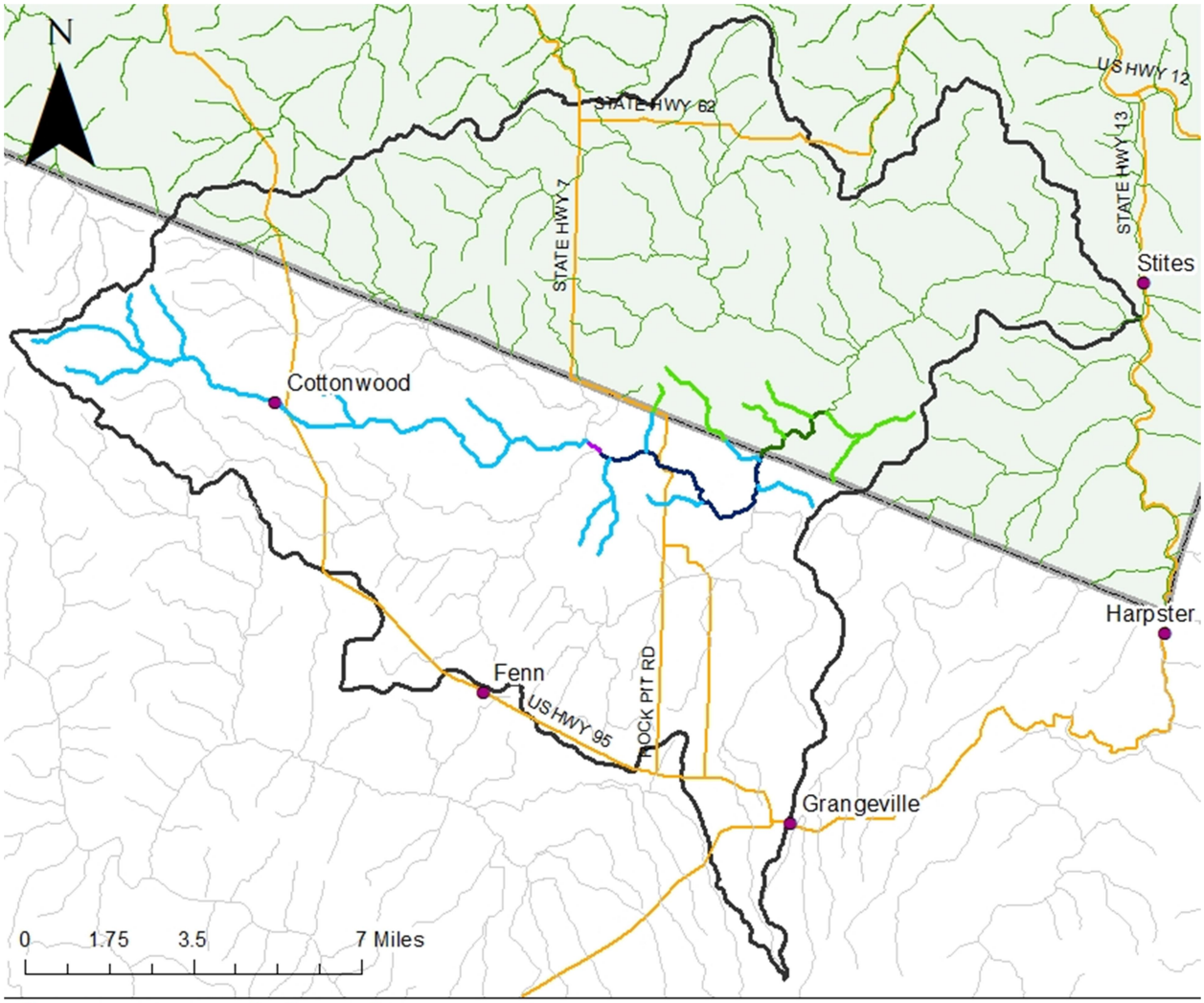
1 Introduction

Cottonwood Creek is a tributary to the South Fork Clearwater River located in Idaho County, ID (Figure 1). Main stem Cottonwood Creek flows west to east, descending from Cottonwood Butte in the west and joins the South Fork Clearwater River near the town of Stites, ID. The AUs addressed in this 5-year review are listed as impaired by ammonia under the Clean Water Act. An ammonia total maximum daily load (TMDL) was developed for Cottonwood Creek in 2000 (DEQ, 2000). The TMDL identified the City of Cottonwood wastewater treatment plant (WWTP) as a significant ammonia source to Cottonwood Creek. A detailed assessment and characterization of the Cottonwood Creek watershed and pollutant sources can be found in the 2000 TMDL.

This document reviews the status of assessment units (AU) in the Cottonwood Creek watershed that were addressed by the Cottonwood Creek ammonia TMDL (DEQ, 2000). The purpose of this 5-year review is to evaluate current water quality data, the appropriateness of the TMDL to current watershed conditions, and any available implementation plans. Based on this review, changes have been recommended for Idaho's next Integrated Report.

1.1 Ammonia

Ammonia is a form of nitrogen that exists in water as a dissolved gas (un-ionized ammonia, NH_3), ammonium hydroxide (NH_4OH) and ammonium ion (NH_4^+). These compounds exist in equilibrium, and the proportion of each compound depends on pH and temperature. NH_4OH is toxic to aquatic organisms, especially fish, and the proportion of NH_4OH present increases as pH and temperature increase. Total ammonia nitrogen (TAN) is the nitrogen concentration (mg N/L) present as NH_3, NH_4OH, and NH_4^+. Idaho's ammonia water quality standards define maximum allowable TAN concentrations that depend on pH and temperature. The standard is set at a level that protects against toxic effects of NH_4OH on aquatic life. Most commonly-used laboratory analytical methods for ammonia measure ammonia as TAN. Throughout this document, 'ammonia' and 'total ammonia nitrogen' (TAN) are used interchangeably.



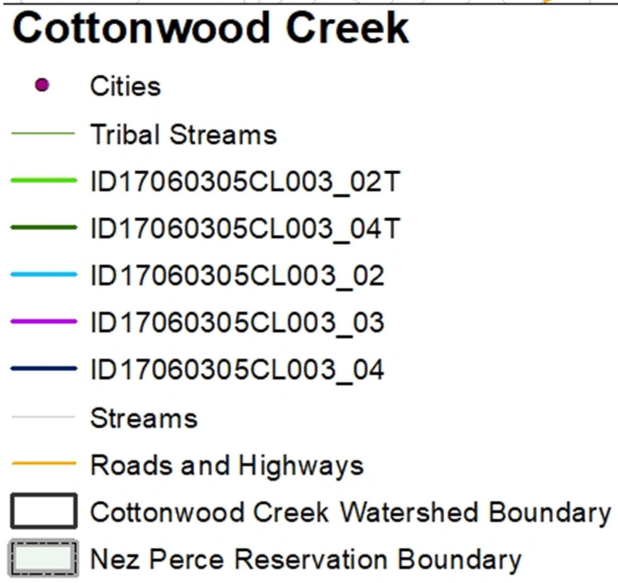


Figure 1. Cottonwood Creek assessment units addressed in this TMDL review.

1.2 Public Involvement

This 5-year review was conducted with participation from the South Fork Clearwater Watershed Advisory Group (WAG). A draft of this document was presented to the WAG in a public meeting in Grangeville on June 10th, 2021. During a July 8, 2021 public WAG meeting in Grangeville, DEQ presented edits made based on stakeholder feedback, and the WAG voted to finalize this TMDL review document.

1.3 Regulatory Requirements

The federal Clean Water Act (CWA) requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters. States and tribes, pursuant to Section 303 of the CWA, are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the nation's waters whenever possible. Water quality standards define the use or uses for the water that must be protected, set water quality criteria necessary to protect those uses, and prevent degradation of water through antidegradation provisions.

Section 303(d) of the CWA establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards). States and tribes must periodically publish a priority list (a "§303(d) list") of impaired waters. Currently, this list is published every 2 years as the list of Category 5 waters in Idaho's Integrated Report. For waters identified on this list, states and tribes must develop a total maximum daily load (TMDL) for the pollutants, set at a level to achieve water quality standards. TMDLs must be reviewed and approved by EPA.

Idaho Code § 39-3611(7) requires a 5-year cyclic review process for Idaho TMDLs:

> The director shall review and reevaluate each TMDL, supporting subbasin assessment, implementation plan(s) and all available data periodically at intervals of no greater than five (5) years. Such reviews shall include the assessments required by section 39-3607, Idaho Code, and an evaluation of the water quality criteria, instream targets, pollutant allocations, assumptions and analyses upon which the TMDL and subbasin assessment were based. If the members of the watershed advisory group, with the concurrence of the basin advisory group, advise the director that the water quality standards, the subbasin assessment, or the implementation plan(s) are not attainable or are inappropriate based upon supporting data, the director shall initiate the process or processes to determine whether to make recommended modifications. The director shall report to the legislature annually the results of such reviews.

This report documents DEQ's review of the Cottonwood Creek ammonia TMDL (DEQ, 2000). It considers the most current and applicable information in conformance with Idaho Code § 39-3607, evaluates the appropriateness of the TMDL to current watershed conditions, and was developed in consultation with a watershed advisory group (WAG). The Idaho Department of Environmental Quality (DEQ) director makes final decisions regarding TMDL modifications. If TMDL modifications are needed, DEQ must develop a revised TMDL document, which must be reviewed and approved by EPA.

1.4 Assessment Units

DEQ subdivides Idaho surface waters into water bodies and assessment units (AUs). Idaho Water Quality standards delineate water bodies and assign a unique water body identification number (WBID) to each water body. Idaho Water Quality standards also define beneficial uses that must be protected for each WBID. An AU is a subsection of a WBID delineated based on the National Hydrography Dataset. AUs are groups of streams with similar hydrology, land use practices, ownership, or land management. Idaho delineates AUs primarily based on Strahler stream order, although additional factors such as land use, landscape physical characteristics, and local knowledge may be considered (DEQ, 2020).

DEQ assesses if water quality standards are met and if beneficial uses are supported at the AU scale. To fulfill CWA §303(d) and §305(b) reporting requirements, Idaho's Integrated Report describes the beneficial use support status of all AUs in Idaho. Idaho began using assessment units in Idaho's 2002 Integrated Report (DEQ, 2005), following EPA guidance (EPA, 2001). Since then, new TMDLs have also been developed at the AU scale. The Cottonwood Creek TMDL (DEQ, 2000) was developed prior to implementation of the AU system. Therefore, water quality targets, loads, load capacities, and other TMDL components were not developed at the AU scale; they were developed for specific WBIDs or in some cases larger stream segments. When Idaho moved to the AU system, all AUs within a WBID where a TMDL was developed were placed in Category 4a of Idaho's Integrated Report (impaired with an approved TMDL).

1.5 Tribal Waters Policy

Because portions of the Cottonwood Creek watershed are within the Nez Perce Reservation, the 2000 Cottonwood Creek TMDL was developed under a memorandum of agreement between DEQ, the Nez Perce Tribe, and EPA. The TMDLs used a watershed approach, and agencies cooperatively developed water quality goals for all streams, including those spanning reservation boundaries. Since then, Idaho tribes and EPA requested that DEQ no longer assess or report water quality information for waters within reservation boundaries (see public comments in Idaho's 2002 Integrated Report [DEQ, 2005]). In response, DEQ developed a tribal waters policy cooperatively with Idaho Indian tribes and EPA. The policy is described in detail in Idaho's Integrated Report (DEQ 2018, DEQ 2020).

DEQ first implemented the tribal waters policy in Idaho's 2018/2020 Integrated Report (DEQ, 2020). DEQ split Idaho's AUs at EPA-recognized reservation boundaries. AUs wholly within reservation boundaries after the split were labeled as tribal waters and placed in their own Integrated Report category (Category 3t) with all beneficial uses unassessed. The policy states DEQ will not sample, assess support of beneficial uses, or develop TMDLs for waters within tribal boundaries.

1.6 NPDES and IPDES Permits

The Cottonwood Creek TMDL identified the City of Cottonwood WWTP as a significant ammonia source to Cottonwood Creek. In 2002, EPA issued a National Pollution Discharge Elimination System (NPDES) permit for the City of Cottonwood WWTP (USEPA, 2002). EPA did not include an ammonia effluent limit in the permit; EPA stated "sufficient data are not available to provide a specific wasteload allocation at this time" (EPA, 2001). A wasteload allocation is the amount of pollutant load a TMDL allows from a point source. Effluent limits in point source permits must be set at a level that achieves wasteload allocation requirements if a wasteload allocation has been defined. Although the Cottonwood Creek TMDL did define a wasteload allocation, EPA determined the wasteload allocation did not include the details needed to develop an effluent limit. Instead, the NPDES permit required the City of Cottonwood to monitor and report TAN concentrations from one effluent sample per month, and included a clause that "allows modification of the permit if results of the monitoring program show a modification is necessary to comply with the state's water quality standards" (EPA, 2001). When the NPDES permit expired September 30, 2007, EPA administratively continued it without modification. In July 2018, EPA granted DEQ authority to regulate discharges from municipal WWTPs under the Idaho Pollution Discharge Elimination System (IPDES) program. Authority for administering the City of Cottonwood WWTP's existing NPDES permit transferred from EPA to DEQ.

In 2021, DEQ issued a draft IPDES discharge permit for the City of Cottonwood WWTP (permit No. ID0021849) that included ammonia effluent limits. The draft permit includes interim effluent limits that must be achieved while the City takes steps to improve its treatment system, and a final effluent limit based on Idaho's current ammonia criteria (IDAPA 58.01.02.250.02d) that must be achieved by 2028.

2 TMDL Review and Status

In 2000, DEQ, Nez Perce Tribe (NPT), and EPA determined ammonia concentrations in Cottonwood Creek exceeded Idaho's ammonia water quality criteria and impaired Cold Water Aquatic Life use based on 1996-1998 monitoring data. DEQ, NPT, and EPA jointly developed an ammonia TMDL (DEQ, 2000) that identified the City of Cottonwood wastewater treatment plant (WWTP) as a significant ammonia source, and required the WWTP to decrease ammonia loading by 5% to meet Idaho's ammonia water quality criteria. DEQ then listed the Cottonwood Creek main stem as impaired by ammonia under the Clean Water Act in Idaho's Integrated Report (IR) as a Category 4a waterbody (impaired with an approved TMDL). Assessment units addressed by the 2000 Cottonwood Creek TMDL are listed in Table 1.

Table 1. Assessment units addressed by the 2000 Cottonwood Creek ammonia TMDL.

Assessment Unit Name	Assessment Unit Number	Pollutant[a]	Numeric Criteria[b]	Critical Period	Relevant TMDL Document
Cottonwood Creek - source to Cottonwood Creek waterfall	ID17060305CL003_02	ammonia	CMC;CCC	May-Sep	DEQ, 2000
Cottonwood Creek - source to Cottonwood Creek waterfall Tribal Water	ID17060305CL003_02T	ammonia	CMC;CCC	May-Sep	DEQ, 2000
Cottonwood Creek - source to Cottonwood Creek waterfall	ID17060305CL003_03	ammonia	CMC;CCC	May-Sep	DEQ, 2000
Cottonwood Creek - source to Cottonwood Creek waterfall	ID17060305CL003_04	ammonia	CMC;CCC	May-Sep	DEQ, 2000
Cottonwood Creek - source to Cottonwood Creek waterfall Tribal Water	ID17060305CL003_04T	ammonia	CMC;CCC	May-Sep	DEQ, 2000

a Ammonia as TAN = Total Ammonia Nitrogen
b CMC = Criterion Maximum Concentration, CCC = Criterion Continuous Concentration; both criteria depend on pH and temperature, see Appendix A

2.1 Pollutant Targets

A pollutant target is a numeric threshold used to determine if a water quality standard is achieved. The Cottonwood Creek TMDL defined total ammonia nitrogen (TAN) targets based on Idaho's ammonia water quality criteria in place in the time. TAN concentrations allowable under Idaho's ammonia criteria depend on pH and temperature. Therefore, TMDL targets were defined considering seasonal variation in pH and temperature. One target was defined for April-October, when pH and temperature are typically highest, but the City of Cottonwood WWTP does not discharge. A second target was defined for November to March, when pH and temperature are lower, but the WWTP discharges, increasing TAN concentrations. Typical pH and temperature conditions during these periods were used to calculate the maximum allowable 4-day average TAN concentration based on the ammonia criteria in place in 2000.

- April to October period – 0.16 mg N/L, the criteria at 28 °C and pH of 8.6
- November to March period – 1.24 mg N/L, the criteria at 16 °C and pH of 8.0

Idaho's ammonia water quality criteria changed in 2002 and the criteria used to develop the TMDL targets no longer apply. The current criteria were adopted in 2002, and using the same pH and temperature values listed above would translated to target concentrations of 0.39 mg N/L for April to October and 2.21 mg N/L for November to March, based on Idaho's chronic criterion (Appendix A). DEQ developed Idaho's current ammonia criteria based on EPA guidance to be

protective of beneficial uses and believes that beneficial uses will be supported when current criteria are achieved.

2.2 Control and Monitoring Points

2.2.1 Description

Control points are specific locations where progress towards meeting targets must be evaluated. The Cottonwood Creek TMDL did not define specific control points; the seasonal targets apply throughout the watershed.

Between 2000 and 2021, DEQ, the Nez Perce Tribe Water Resources Division (NPTWR), Idaho Association of Soil Conservation Districts (IASCD), and Gilmore et al. 2001 measured flow, ammonia, pH and temperature at multiple locations upstream and downstream of the City of Cottonwood WWTP on Cottonwood Creek. Data are available for 9 different sample locations. Monitoring locations are documented in detail in Appendix B and in section 3.2 below.

Because the City of Cottonwood WWTP appears to be the primary ammonia source to Cottonwood Creek, monitoring should continue at locations above and below the City of Cottonwood WWTP after its IPDES permit has been issued and implemented. Continued monitoring will document water quality responses to WWTP improvements. If water quality criteria are not met in Cottonwood Creek when effluent limits in the city's discharge permit are met, then expanded monitoring should be implemented to identify additional ammonia sources.

2.3 Load Capacity

A load capacity is the maximum pollutant load (often expressed as mass/time) that a water body can receive without violating water quality standards (40 CFR §130.2(f)). Load capacities are typically calculated by multiplying pollutant target concentrations by stream flow and a unit conversion factor. Therefore, load capacity protectiveness depends on target protectiveness.

The executive summary of the Cottonwood Creek ammonia TMDL (DEQ, 2000, p1-7) specifies a 742 lbs N/season load ammonia load capacity for Cottonwood Creek. The TMDL does not clearly document how that value was calculated, which season it applies to, or which seasonal target was used to calculate it. Load capacities are generally calculated as a product of target concentration as flow as illustrated in the equation below:

$$Load\ Capacity = ammonia\ target\ \left({}^{mg}/_{L}\right) \times flow\ \left({}^{ft^3}/_{sec}\right) \times unit\ conversion\ factor$$

(equation 1)

Where the unit conversion factor converts units to lbs/day. Therefore, if the target is exceeded, load capacities are also exceeded.

In the 2000 TMDL, ammonia concentrations in the Cottonwood Creek watershed were compared to the 4-day average ammonia criterion applicable at the time (DEQ, 2000, Table 51). For this TMDL review, 2019-2021 DEQ monitoring data were compared to Idaho's current criteria (IDAPA 58.01.02.250.02d, Appendix A). The load capacity was considered exceeded when the

current criteria were exceeded. The chronic criterion was exceeded approximately one mile downstream of the WWTP at the Nuxoll Road crossing (assessment unit ID17060305CL003_02) during periods the WWTP discharged. Criteria were not exceeded a this site when the WWTP did not discharge or upstream of the WWTP. Criteria were also not exceeded downstream of Nuxoll Road near the Nez Perce Reservation Boundary (ID17060305CL003_04). A detailed description of monitoring methods, results, and criteria exceedances is provided in Appendix B.

Federal regulations require load capacity calculations to "take into account critical conditions for stream flow, loading, and water quality parameters" (40 CFR §130.7(c)(1)). Federal regulations do not define what 'critical conditions' means. In TMDLs 'critical conditions' are often described as the conditions or time period when water quality standards or targets are most likely to be violated, or as the conditions or time period where the TMDL target applies. In the 2000 TMDL, seasonality was accounted for by defining seasonal targets.

2.4 Load and Wasteload Allocations

Load allocations are the portion of the load capacity attributed to existing and future nonpoint sources, and to natural background. Wasteload allocations are the portion of load capacity attributed to existing and future point sources.

The Cottonwood Creek TMDL (DEQ, 2000) set a 0 lb/day ammonia wasteload allocation for the City of Cottonwood WWTP during May to September because the City does not discharge during that time period. The TMDL also required a 5% ammonia load reduction from the City of Cottonwood WWTP during November to April to achieve water quality standards during the WWTP discharge period The TMDL did not clearly state a load allocation for nonpoint sources.

2.5 Margin of Safety

TMDLs must include a margin of safety (MOS) to account for uncertainties that may affect the protectiveness of a TMDL. An MOS reduces the pollutant load available for allocation to nonpoint and point sources, and can be explicit (quantitative) or implicit (based on conservative assumptions).

The Cottonwood Creek ammonia TMDL included an implicit MOS that relies on the use of conservative assumptions. At the time the TMDL was developed, criteria existed for both one-hour and 4-day averages, with the 4-day average being the lower of the two. The more conservative 4-day criterion was used to examine criteria exceedances and select TMDL targets. Additionally, the seasonal targets are based on temperature and pH conditions that are higher than what was observed in sampling data collected at the time (DEQ, 2000), representing worst-case conditions. If the TMDL were to be revised based on the current ammonia criteria, a revised MOS would also be needed.

2.6 Seasonal Variation

TMDLs must consider how seasonal variation affects pollutant patterns and effects. The TMDL addressed seasonality by establishing targets for an April-October period with seasonal peaks in

pH and temperature, and for a November-March period with ammonia peaks during WWTP discharge. The TMDL also included seasonal wasteload allocations.

2.7 Reserve

Some TMDLs include a reserve for growth to account for additional pollutant loading anticipated in the future. The Cottonwood Creek TMDL does not include a reserve for growth.

2.8 Changes to Subbasin Characteristics

Since the Cottonwood Creek TMDL was finalized in 2000, there have been several administrative changes relevant to the TMDL. First, Idaho's ammonia water quality criteria changed in 2002; the criteria used to develop TMDL concentration target and load requirements no longer apply. This TMDL review compared recent ammonia monitoring results to Idaho's current criteria.

Second, the City of Cottonwood WWTP does not currently discharge under a permit that includes an ammonia effluent limit, but likely will in the near future. The City of Cottonwood currently discharges under a National Pollution Discharge Elimination System (NPDES) permit issued by EPA that does not include an ammonia effluent limit. In July 2018, EPA granted DEQ authority to regulate discharges from municipal WWTPs under the Idaho Pollution Discharge Elimination System (IPDES) program. Authority for administering the City of Cottonwood WWTP's existing NPDES permit transferred from USEPA to DEQ. In 2021, DEQ issued a draft IPDES discharge permit for the City of Cottonwood WWTP (permit No. ID0021849) that includes ammonia effluent limit. The draft permit includes interim effluent limits that must be achieved while the City takes steps to improve its treatment system, and a final effluent limit based on Idaho's current ammonia criteria (IDAPA 58.01.02.250.02d) that must be achieved by 2028. At the time this TMDL review was written, DEQ had not yet finalized and issued the IPDES permit, so ammonia effluent limits are not yet in place.

Third, Idaho tribes and EPA requested that DEQ no longer assess or report water quality information for waters within reservation boundaries (see public comments in Idaho's 2002 Integrated Report [DEQ, 2005]). In response, DEQ developed a tribal waters policy cooperatively with Idaho Indian tribes and EPA (DEQ, 2018). DEQ now splits stream at EPA-recognized reservation boundaries. DEQ labels steam segments within reservation boundaries as tribal waters and places them in their own Integrated Report category (Category 3t) with all beneficial uses unassessed. The policy states DEQ will not sample, assess support of beneficial uses, or develop TMDLs for waters within tribal boundaries. Therefore, although the Cottonwood Creek ammonia TMDL addressed stream segments inside and outside the reservation, DEQ no longer assesses or develops TMDLs for segments within the Nez Perce Reservation boundary. This TMDL review focuses primarily on stream segments outside the reservation boundaries. See section 1.5 for details.

Watershed land use patterns have not changed substantially since the TMDL was finalized in 2000 (Table 2). Several water quality improvement projects have been completed (Table 3). These projects helped agricultural producers implement agricultural best management practices. These projects likely helped reduce nutrient inputs to Cottonwood Creek. Historic and recent

monitoring data in Appendix B suggest the City of Cottonwood WWTP is the primary ammonia source to Cottonwood Creek.

Table 2. Comparison of land use patterns reported in the Cottonwood Creek TMDL (2000) to 2016 National Land Cover data. NA = category not included in dataset.

Time Period	Cropland	Pasture / Grassland/ Range	Forestland	Urban /Industrial	Shrubland
TMDL (2000)	74%	20%	6%	<1%	NA
Current (2016)	72.8%	15.6%	4.6%	3.5%	3.4%

Table 3. Inventory of water quality improvement projects in the Cottonwood Creek watershed since 2000.

Area	Category	Agency	Project Name	Years	Status	Focus BMPs	Pollutants Addressed				Cost	Funding Source(s)
							Sed	Bact	Nutr	Temp		
Cottonwood Cr	Ag & Livestock	Idaho SWCD	South Fork Cottonwood Creek BMP Implementations	2001–2003	complete	Residue management, nutrient management, livestock facilities	x	x	x	—	$286,159	CWA §319 grant
Cottonwood Cr	Ag & Livestock	Idaho SWCD	Cottonwood BMP Implementations	2001–2004	complete	Residue management, nutrient management, livestock facilities	x	x	x	—	$208,604	Idaho WQPA
Cottonwood Cr	Ag & Livestock	Idaho SWCD	Cottonwood Creek Restoration	2011–2014	complete	Residue management, nutrient management, livestock facilities	x	x	x	—	$311,396	Snake River Basin Adjudication
Cottonwood Cr	Ag & Livestock	Idaho SWCD	Cottonwood Phase 2 BMP Implementations (§319)	2003–2007	complete	Residue management, nutrient management, livestock facilities	x	x	x	—	$247,974	CWA §319 grant
Cottonwood Cr	Ag & Livestock	Idaho SWCD	Cottonwood Phase 2 BMP Implementations (WQPA)	2003–2011	complete	Residue management, nutrient management, livestock facilities	x	x	x	—	$200,000	Idaho WQPA
Red Rock Cr	Ag & Livestock	Idaho SWCD	Red Rock Creek Livestock BMP Implementations—Phase 2	2019–2022	ongoing	Livestock facilities	x	x	x	—	$177,684	CWA §319 grant
Red Rock Cr	Ag & Livestock	Idaho SWCD	Red Rock Creek AFO Implementation Project	2017–2018	complete	Livestock facilities	x	x	x	—	$128,237	State Ag Fund
Camas Prairie	Ag & Livestock	Idaho SWCD	Western Camas Prairie Culvert Replacement	2016–2018	complete	Sediment management	x	—	—	—	$184,925	CWA §319 grant

Area	Category	Agency	Project Name	Years	Status	Focus BMPs	Pollutants Addressed				Cost	Funding Source(s)
							Sed	Bact	Nutr	Temp		
Camas Prairie	Ag & Livestock	PCEI	South Fork Clearwater Watershed Vegetation	2010–2014	complete	Riparian vegetation, channel stabilization, drainage water management, wetland	x	x	x	x	$246,261	CWA §319 grant
Camas Prairie	Ag & Livestock	Latah SWCD	North Idaho Division II Animal Feeding Project	2002–2012	complete	Region-wide livestock project; subset of funds used locally	—	x	x	—	—	CWA §319 grant, Idaho WQPA
Camas Prairie	Ag & Livestock	Idaho SWCD	South Fork Clearwater River BMP Implementations	2007–2012	complete	Residue management, nutrient management, livestock facilities	x	x	x	—	$500,014	Idaho WQPA
Camas Prairie	Ag & Livestock	Idaho SWCD	South Fork Clearwater River BMP Implementations (§319)	2010–2013	complete	Residue management, nutrient management, livestock facilities	x	x	x	—	$250,000	CWA §319 grant

3 Beneficial Use Status

Idaho water quality standards (IDAPA 58.01.02) list beneficial uses and set water quality goals for waters of the state. Idaho water quality standards require that surface waters of the state be protected for beneficial uses, wherever attainable (IDAPA 58.01.02.050.02). These beneficial uses are interpreted as existing uses, designated uses, and presumed uses and are described in more detail at *https://www.deq.idaho.gov/water-quality/surface-water/water-quality-standards/*. The Water Body Assessment Guidance (DEQ, 2016a) provides a more detailed description of beneficial use identification for use assessment purposes.

Beneficial uses include the following:

- Aquatic life support—cold water, seasonal cold water, warm water, salmonid spawning, and modified
- Contact recreation—primary (e.g., swimming) or secondary (e.g., boating)
- Water supply—domestic, agricultural, and industrial
- Wildlife habitats
- Aesthetics

3.1 Beneficial Uses

Idaho Water Quality Standards designate Cold Water Aquatic Life and Salmonid Spawning as beneficial uses that must be protected in Cottonwood Creek (Table 5). Idaho's past and current ammonia criteria are the same for both Cold Water Aquatic Life and Salmonid Spawning; achieving ammonia criteria is assumed to protect both Cold Water Aquatic Life and Salmonid Spawning uses.

Table 4. Beneficial uses of water bodies addressed by this 5-year review.

Assessment Unit Name	Assessment Unit Number	Tribal AU	Designated Uses[a]
Cottonwood Creek - source to Cottonwood Creek waterfall	ID17060305CL003_02	No	CWAL; SS
Cottonwood Creek - source to Cottonwood Creek waterfall Tribal Waters	ID17060305CL003_02T	Yes	CWAL; SS
Cottonwood Creek - source to Cottonwood Creek waterfall	ID17060305CL003_03	No	CWAL; SS
Cottonwood Creek - source to Cottonwood Creek waterfall	ID17060305CL003_04	No	CWAL; SS
Cottonwood Creek - source to Cottonwood Creek waterfall Tribal Waters	ID17060305CL003_04T	Yes	CWAL; SS

[a] CWAL = Cold Water Aquatic Life; SS = Salmonid Spawning

Available biological data suggest multiple fish species are present in Cottonwood Creek segments outside the reservation boundary. The Cottonwood Creek TMDL (DEQ 2000) described biological communities present in upper main stem Cottonwood Creek, and stated fish species present include black bullhead, pumpkinseed, redside shiner, and speckled dace. DEQ Beneficial Use Reconnaissance Program (BURP) monitoring documented redside shiner and dace in Cottonwood Creek within ID17060305CL003_04 near the reservation boundary in 2001, 2006, and 2018. DEQ has not monitored fish species present in ID17060305CL003_02 because

water was too shallow to electrofish during summer BURP crew visits. However, 2018 and 2019 BURP monitoring documented the presence of dace in several tributaries of Cottonwood Creek, including Long Haul Creek and South Fork Cottonwood Creek, so dace are likely also present within ID17060305CL003_02. Salmonids are not present in the Cottonwood Creek segments addressed in this TMDL review. However, the absence of salmonids does not affect whether Idaho's ammonia criteria apply or the ammonia concentration that must be achieved. Idaho's ammonia criteria are the same for protection of both Cold Water Aquatic Life and Salmonid Spawning uses.

3.2 Summary and Analysis of Current Water Quality Data

This section summarizes Cottonwood Creek ammonia patterns and criteria exceedances. A comprehensive description of available data, sample locations, monitoring and analysis methods, and criteria exceedances is included in Appendix B.

DEQ monitored Cottonwood Creek ammonia concentrations 2019-2021, and gathered external Cottonwood Creek water quality data collected by various agencies since 2000. Data were available at 9 different monitoring locations (Figure 2, Table 3). Using these data, DEQ evaluated whether Cottonwood Creek total ammonia nitrogen (TAN) concentrations exceed Idaho's current ammonia water quality criteria (IDAPA 58.01.02.250.02d), and compared TAN concentrations upstream and downstream of the City of Cottonwood WWTP.

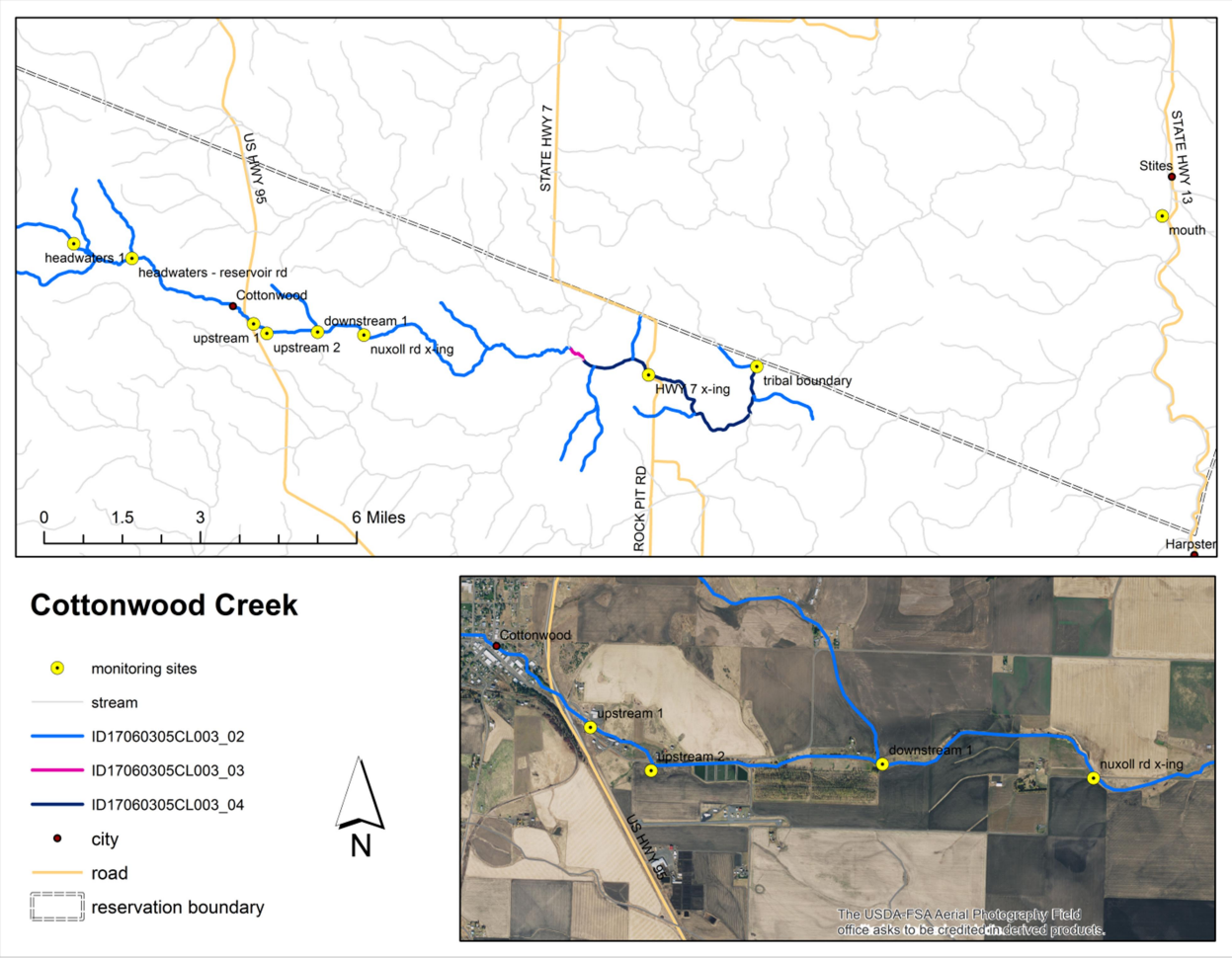


Figure 2. Cottonwood creek assessment units and monitoring locations. See Appendix B monitoring location details.

3.2.1 Criteria Exceedances

Idaho Water Quality Standards include acute and chronic ammonia criteria for protection of aquatic life (IDAPA 58.01.02.250.02d). The concentrations that must be achieved depend on pH for the acute criterion and on both temperature and pH for the chronic criterion.

The acute criterion requires that the one hour average TAN concentration does not exceed the criterion maximum concentration (CMC) calculated based on pH more than once during a three year period.

i. Acute Criterion (Criterion Maximum Concentration (CMC)). The one (1) hour average concentration of total ammonia nitrogen (in mg N/L) is not to exceed, more than once every three (3) years, the value calculated using the following equation:

$$CMC = \frac{0.275}{1 + 10^{7.204-p}} + \frac{39.0}{1 + 10^{pH-7.204}}$$

To determine if the acute criterion was exceeded, CMC values were calculated based on pH measured at the same time each ammonia sample was collected, and then compared to corresponding TAN results. Across all samples collected 2000-2020, CMC concentrations were exceeded twice (2/25/2001, 1/15/2020) approximately 1 mile downstream of the WWTP where Cottonwood Creek crosses Nuxoll Road. However, the acute criterion was not violated at the Nuxoll Road site because CMC concentrations were not exceeded more than once during a three year period during flow conditions when criteria apply (> 1 cfs). . CMC concentrations were also not exceeded further downstream or upstream of the WWTP.

Table 5. Criterion maximum concentration (CMC) exceedances.

Site	Date	Flow (cfs)	pH	Temperature (ºC)	Acute Criterion (CMC) (mg N/L)	TAN (mg N/L)
Nuxoll Rd	2/25/2001	7.28	8.9	0.1	1.0	1.7
Nuxoll Rd	1/15/2020	1.07	8.2	1.7	3.8	6.97

The chronic criterion requires that the 30-day average TAN concentration does not exceed the criterion continuous concentration (CCC) calculated based on pH and temperature more than once every three years. The equation used to calculate CCC values depends on whether fish early life stages are present. To determine if the chronic criterion was exceeded, DEQ calculated CCC values assuming fish early life stages were present.

(1) The thirty (30) day average concentration of total ammonia nitrogen (in mg N/L) is not to exceed,more than once every three (3) years, the value calculated using the following equations: (3-15-02)

(a) When fish early life stages are likely present:

$$CCC = \left(\frac{0.0577}{1 + 10^{7.688-}} + \frac{2.487}{1 + 10^{pH- .688}}\right) * MIN\left(2.85, 1.45 * 10^{0.028(25-T)}\right)$$

(b) When fish early life stages are likely absent:

$$CCC = \left(\frac{0.0577}{1 + 10^{7.688-pH}} + \frac{2.487}{1 + 10^{pH-7.688}}\right) * \left(1.45 * 10^{0.028(25-T)}\right)$$

Rolling 30-day arithmetic mean pH and temperature values were used to calculate CCC values. CCC values were then compared to corresponding rolling 30-day arithmetic mean TAN results. The chronic criterion was exceeded at the Nuxoll road crossing site 19 times, including 9 times 2020-2021 (Table 6). The chronic criterion was not exceeded further downstream where Cottonwood Creek crosses Highway 7 or at the Nez Perce Reservation boundary within ID17060305CL003_04. The chronic criterion also was not exceeded at sites upstream of the WWTP.

Cottonwood Creek is intermittent at the Nuxoll Road crossing site where criteria exceedances were observed. DEQ has documented this segment as dry or having no flow during summer on multiple occasions. For intermittent streams, numeric criteria for protection of aquatic life only apply when flow exceeds 1 cubic feet per second (cfs) (IDAPA 58.01.02.010.54 and .02.070.06). Therefore, DEQ only evaluated whether acute and chronic criteria were exceeded within ID17060305CL003_02 sites when individual or rolling 30 day mean flows exceeded 1 cfs.

Within ID17060305CL003_02, there were 7 sample events where TAN exceeded the CMC but stream flow was less than 1 cfs, so numeric criteria for protection of aquatic life did not apply (IDAPA 58.01.02.010.54 and .070.06). There were also 7 cases where rolling 30 day mean concentrations exceeded CCC, but rolling 30 day mean flow was less than 1 cfs, so numeric criteria for protection of aquatic life did not apply.

Table 6. Chronic criterion concentration (CCC) exceedances. Flow, pH, temperature, and TAN values are 30-day rolling means.

Site	Date	Flow (cfs)	pH	Temperature (ºC)	CCC (mg N/L)	TAN (mg N/L)
downstream 1	2/25/2001	1.2	8.55	0.7	1.0	2.36
Nuxoll Rd	1/28/2001	1.61	8.04	1.35	2.3	3.08
Nuxoll Rd	2/25/2001	2.53	8.25	2.28	1.65	2.63
Nuxoll Rd	2/2/2005	1.49	8.06	1.73	2.23	3.19
Nuxoll Rd	2/14/2005	1.87	8.03	1.66	2.33	2.98
Nuxoll Rd	3/2/2005	2.68	8.23	2.43	1.71	1.99
Nuxoll Rd	1/19/2006	1.59	7.8	1.42	3.18	3.43
Nuxoll Rd	2/10/2006	1.65	8.07	1.5	2.19	3.33
Nuxoll Rd	1/11/2012	1.24	7.62	1.03	3.9	4.69
Nuxoll Rd	2/14/2012	2.56	8.13	2.38	2.0	2.42
Nuxoll Rd	1/15/2020	1.6	8.06	1.65	2.23	3.54
Nuxoll Rd	1/29/2020	1.99	8.03	1.75	2.33	3.2
Nuxoll Rd	1/30/2020	2.08	8.08	2.19	2.16	2.88
Nuxoll Rd	2/21/2020	3.21	8.22	3.03	1.74	1.77
Nuxoll Rd	1/12/2021	1.68	8.03	1.64	2.33	2.97
Nuxoll Rd	1/20/2021	1.55	8.07	1.71	2.19	3.36
Nuxoll Rd	1/25/2021	1.6	8.06	1.65	2.23	3.41
Nuxoll Rd	2/1/2021	2.16	8.15	2.45	1.94	2.49
Nuxoll Rd	2/9/2021	2.53	8.16	2.34	1.91	2.46

3.2.2 Comparison of Concentrations Upstream & Downstream of the WWTP

Concentration and criteria exceedance patterns suggested the WWTP is the primary ammonia source to Cottonwood Creek. TAN concentrations were very low and did not exceed criteria upstream of the WWTP. Downstream, TAN concentrations were never exceeded during periods when the WWTP did not discharge effluent. During time periods the WWTP discharged, TAN concentrations were higher downstream of the WWTP at the Nuxoll Road crossing compared to upstream of the WWTP (Figure 3-4). At the Nuxoll Road crossing site, TAN concentrations were similar to those upstream during April-November when the WWTP was not discharging, but increased substantially December-March when the WWTP discharged (Figure 4). During 2019-2021, TAN concentration peaks at the Nuxoll Road site occurred shortly after the WWTP began discharging. The city reported it discharged January 2020 – March 2020, and December-March 2021. The city measured effluent TAN concentrations once per month during these discharge periods, and reported effluent TAN concentrations were 16.5 mg N/L in January 2020, 9.24 mg N/L in February 2020, 6.61 mg N/L in March 2020, 15.8 mg N/L in December 2020, 14.0 mg N/L in January 2021, and 1.59 mg N/L in February 2021. These effluent TAN concentrations were much higher than TAN concentrations observed upstream of the WWTP during the same period (Figures 3-4). Upstream of the WWTP, 52 of 86 samples had TAN

concentrations below the laboratory reporting limit, and all but 2 samples had concentrations < 0.4 mg N/L. The WWTP therefore appears to be the primary TAN source to Cottonwood Creek.

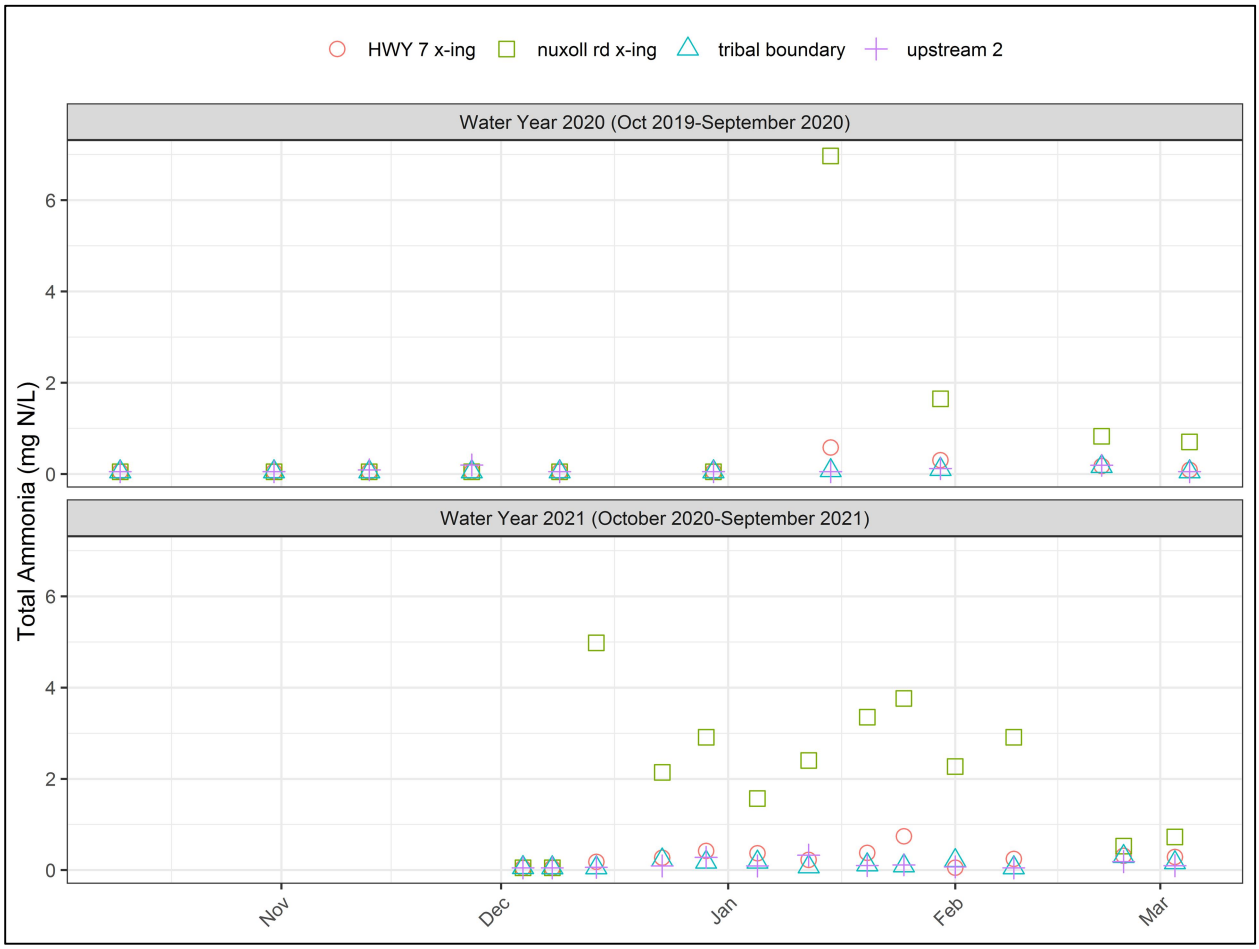


Figure 3. Total ammonia nitrogen (TAN) concentrations during 2019-2021 DEQ monitoring. See Figure 2 and Appendix B for sample location information.

Figure 4. Main stem Cottonwood Creek total ammonia nitrogen (TAN) concentrations 2000-2021. See Figure 2 and Appendix B for sample location information.

3.3 Assessment Unit Summary

This section summarizes conclusions and recommendations for each assessment unit addressed in the 2000 Cottonwood Creek TMDL. Table 7 summarizes recommendations for Idaho's 2022 Integrated Report. Subsections 3.3.1 and 3.3.2 provide more detailed information.

Table 7. Summary of recommended changes for AUs evaluated.

Assessment Unit Name	Assessment Unit Number	Pollutant	Recommended Changes to Next Integrated Report	Justification
Cottonwood Creek - source to Cottonwood Creek waterfall	ID17060305CL003_02	Ammonia	No change; Retain in Category 4a for ammonia	ammonia criteria not achieved
Cottonwood Creek - source to Cottonwood Creek waterfall Tribal Waters	ID17060305CL003_02T	Ammonia	No change; Category 3t, not assessed	Tribal Waters policy
Cottonwood Creek - source to Cottonwood Creek waterfall	ID17060305CL003_03	Ammonia	No change; Retain in Category 4a for ammonia	No data collected to assess criteria
Cottonwood Creek - source to Cottonwood Creek waterfall	ID17060305CL003_04	Ammonia	Delist ammonia as cause of impairment	ammonia criteria achieved
Cottonwood Creek - source to Cottonwood Creek waterfall Tribal Waters	ID17060305CL003_04T[a]	Ammonia	No change; Category 3t, not assessed	Tribal Waters policy

a This Tribal Waters AU within the Nez Perce Reservation Boundary did not exceed water quality criteria for TAN.

3.3.1 Assessment Units in Ammonia TMDL That Are Still Impaired

ID17060305CL003_02, Cottonwood Creek - source to Cottonwood Creek waterfall

- Exceeded chronic ammonia criteria 19 times between 2001 and 2021, including 9 times 2020-2021.
- This AU is the receiving water for the City of Cottonwood WWTP, which appears to be the only significant source of ammonia in the Cottonwood Creek watershed.

ID17060305CL003_03, Cottonwood Creek - source to Cottonwood Creek waterfall

- No available data due to lack of access through private property, criteria were not assessed.

3.3.2 Assessment Units in Ammonia TMDLs Proposed for Delisting

For purposes of the Integrated Report, DEQ refers to a delisting as any AU-cause combination that is removed from Category 4 or Category 5. Delistings have to be supported by a detailed rationale, and must be reviewed and approved by EPA in Idaho's Integrated Report. DEQ will propose to delist ammonia as a cause of impairment in one AU because ammonia concentrations achieve Idaho's ammonia criteria.

ID17060305CL003_04, Cottonwood Creek - source to Cottonwood Creek waterfall

- Monitoring data collected from 1996 to 1998 demonstrated that Cottonwood Creek exceeded Idaho's ammonia water quality criteria and Cold Water Aquatic Life use was impaired (DEQ, 2000).
- In 2000, DEQ, Nez Perce Tribe, and USEPA developed a TAN ammonia TMDL (DEQ, 2000).

- A total of 83 TAN samples were collected across two sites within this AU between 2007 and 2021. Results at these sites ranged from 0.01-0.83 mg N/L and none exceeded CMC or CCC values.
- Idaho's ammonia criteria therefore were achieved within this assessment unit, and DEQ will propose to delist ammonia as a cause of impairment within ID17060305CL003_04 in Idaho's 2022 Integrated Report.

4 Review of Implementation Plan and Activities

The Cottonwood Creek TMDL Implementation Plan was developed by the Idaho Soil Conservation Commission (ISCC) in 2001 (ISCC, 2001). However, since the City of Cottonwood WWTP is the only significant source of ammonia in Cottonwood Creek, reducing effluent ammonia concentrations should be the primary focus of implementation for ammonia.

In 2021, DEQ issued a draft IPDES discharge permit for the City of Cottonwood WWTP (permit No. ID0021849) that included ammonia effluent limits. The draft permit includes interim effluent limits that must be achieved while the City takes steps to improve its treatment system, and a final effluent limit based on Idaho's current ammonia criteria (IDAPA 58.01.02.250.02d) that must be achieved by 2028. DEQ had not yet finalized and issued the permit at the time this document was written.

In 2020, DEQ awarded the City of Cottonwood a grant to prepare a wastewater planning study that will evaluate the City's current wastewater system and develop alternatives for any needed improvements. The study will help the City identify treatment system upgrades necessary to achieve effluent limit requirements. The grant requires the City to submit final facility planning documents to DEQ for review and approval by June 30, 2023.

In addition, at the time this TMDL review was written, the US Department of Agriculture, City of Cottowood, Cottonwood Highway District, and Idaho Transportation Department were in the planning and environmental documentation phase of a Watershed Protection and Flood Prevention Act (Public Law 83-566) project. Project funds were being used to identify potential treatment system upgrade and watershed restoration project alternatives that would help City discharges achieve Idaho water quality standards and reduce flooding in downtown Cottonwood. The project planning and environmental documentation phase will be complete in 2022. Project design and construction phases would follow and will require additional funding.

5 Conclusion

A TMDL analysis was conducted based on requirements established in Idaho Code §39-3611(7). TMDL analyses must include an evaluation of the attainability of beneficial uses as described in §39-3607, and "an evaluation of the water quality criteria, instream targets, pollutant allocations, assumptions and analyses upon which the TMDL were based" (in Idaho Code §39-3611(7)). Table D (page xv) summarizes outcomes of these required analyses, plus analysis of TMDL consistency with Idaho's tribal waters policy and provides recommendations based on outcomes.

Three AUs outside the Nez Perce Reservation boundary in the Cottonwood Creek watershed have TMDLs for ammonia and are addressed in this TMDL review. The Cottonwood Creek ammonia TMDL (DEQ, 2000) was developed to be protective of Cold Water Aquatic Life uses. Based on this review, DEQ believes that these uses are attainable in Cottonwood Creek and does not recommend any changes to beneficial use support status related to ammonia for Idaho's 2022 Integrated Report.

DEQ considers fourth order Cottonwood Creek (AU ID17060305CL003_04) outside of the Nez Perce Reservation boundary to no longer be impaired by ammonia and recommends that ammonia be removed as an impairment cause for this AU in Idaho's 2022 Integrated Report. No data were available to evaluate criteria in third order Cottonwood Creek (AU ID17060305CL003_03) because of private property access constraints, and DEQ assumes that this AU remains impaired due to ammonia. Second order Cottonwood Creek (AU ID17060305CL003_02) exceeded acute and chronic criteria for ammonia and is still impaired due to ammonia. Ammonia criteria exceedances occurred downstream of the City of Cottonwood WWTP, but not above; exceedances also occurred only during the time that the WWTP discharged. These patterns confirm that the WWTP is the primary significant source of ammonia in Cottonwood Creek, consistent with the Cottonwood Creek TMDL (DEQ, 2000).

In accordance with Idaho tribal waters policy (DEQ, 2018), DEQ does not assess support of beneficial uses for waters within reservation boundaries. Instead, tribal waters are classified as unassessed (Category 3t) in Idaho's Integrated Report. In the Cottonwood Creek subwatershed, EPA and the Nez Perce Tribe are responsible for deciding whether TAN still impairs beneficial uses under the CWA for waters within the Nez Perce Tribe Reservation boundary. Therefore, stream segments within the reservation boundary were categorized as unassessed and placed in Category 3t (unassessed tribal waters) in Idaho's 2018/2020 Integrated Report, even if a TAN TMDL was previously developed and approved by EPA (DEQ, 2020). To comply with the tribal waters policy, this will continue in Idaho's 2022 Integrated Report.

The water quality criteria used in the TMDL were revised in 2002 and thus are not consistent with current Idaho Water Quality Standards. However, DEQ does not recommend any changes to the Cottonwood Creek ammonia TMDL because updating the TMDL to use the current ammonia water quality standard would have no practical effect. The City of Cottonwood WWTP is the only significant ammonia source, so IPDES permit effluent limits and WWTP compliance with those limits will control pollutant loading levels. The current draft IPDES permit effluent limit, and limits in future permits, will be based on Idaho's most current ammonia water quality standard, which is protective of Cold Water Aquatic Life use. DEQ should focus its efforts on helping the City of Cottonwood achieve ammonia effluent limits and monitoring stream ammonia responses to City water quality improvement efforts.

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Appendix A. Water Quality Criteria

IDAPA 58.01.02.250.02d (3-15-02):

a. Ammonia. The following criteria are not to be exceeded dependent upon the temperature, T (degrees C), and pH of the water body:

ii. Acute Criterion (Criterion Maximum Concentration (CMC)). The one (1) hour average concentration of total ammonia nitrogen (in mg N/L) is not to exceed, more than once every three (3) years, the value calculated using the following equation:

$$CMC = \frac{0.275}{1+10^{7.204-}} + \frac{39.0}{1+10^{pH-7.204}}$$

iii. Chronic Criterion (Criterion Continuous Concentration (CCC)).

(1) The thirty (30) day average concentration of total ammonia nitrogen (in mg N/L) is not to exceed,more than once every three (3) years, the value calculated using the following equations: (3-15-02)

a. When fish early life stages are likely present:

$$CCC = \left(\frac{0.0577}{1+10^{7.688-}} + \frac{2.487}{1+10^{pH-7.688}}\right) * MIN\left(2.85, 1.45 * 10^{0.028(25-T)}\right)$$

b. When fish early life stages are likely absent:

$$CCC = \left(\frac{0.0577}{1+10^{7.688-pH}} + \frac{2.487}{1+10^{pH-7.688}}\right) * \left(1.45 * 10^{0.028(25-T)}\right)$$

(2) The highest four-day (4) average within the thirty-day (30) period should not exceed two point five (2.5) times the CCC.

(3) Because the Department presumes that many waters in the state may have both spring-spawning and fall spawning species of fish present, early life stages of fish may be present throughout much of the year. Accordingly, the Department will apply the CCC for when fish early life stages are present at all times of year unless:

(a) Time frames during the year are identified when early life stages are unlikely to be present, and

(b) The Department is provided all readily available information supporting this finding such as the fish species distributions, spawning periods, nursery periods, and the duration of early life stages found in the water body; and

(c) The Department determines early life stages are likely absent.

Appendix B. Water Quality Monitoring Data, Analysis, Methods and Results

REPORT

Cottonwood Creek Total Ammonia Nitrogen Concentrations and Criteria Exceedances, 2000-2021

Jason Williams, Idaho Department of Environmental Quality Lewiston Regional Office

5-12-2021

Summary

Cottonwood Creek is a tributary of the South Fork Clearwater River located in Idaho County, Idaho. The main stem of Cottonwood Creek is listed as impaired by ammonia under the Clean Water Act. An ammonia total maximum daily load (TMDL) was developed for Cottonwood Creek in 2000. The TMDL identified the City of Cottonwood wastewater treatment plant (WWTP) as a significant ammonia source to Cottonwood Creek. The Idaho Department of Environmental Quality (DEQ) gathered Cottonwood Creek water quality data collected by various agencies since 2000, and monitored Cottonwood Creek ammonia concentrations 2019-2021. Using these data, DEQ evaluated whether Cottonwood Creek total ammonia nitrogen (TAN) concentrations exceed Idaho's current ammonia water quality criteria (IDAPA 58.01.02.250.02d), and compared TAN concentrations upstream and downstream of the WWTP. During periods when the WWTP discharged effluent, TAN concentrations exceeded ammonia criteria approximately 1 mile downstream of the WWTP, where Cottonwood Creek crosses Nuxoll Road. TAN concentrations did not exceed criteria downstream during periods when the WWTP did not discharge effluent, and did not exceed criteria upstream of the WWTP. These patterns indicate ammonia criteria are exceeded downstream of the WWTP, and the WWTP is the primary ammonia source to Cottonwood Creek.

Data associated with this report are publically available at: *https://osf.io/gmvh4*, DOI 10.17605/OSF.IO/GMVH4

1.0 Background

In 2000, the Idaho Department of Environmental Quality (DEQ), Nez Perce Tribe (NPT), and US Environmental Protection (USEPA) agency determined total ammonia nitrogen (TAN) concentrations in Cottonwood Creek exceeded Idaho's ammonia water quality criteria and impaired Cold Water Aquatic Life use (DEQ, 2000) based on 1996-1998 monitoring data. DEQ, NPT, and EPA jointly developed a TAN total maximum daily load (TMDL) that identified the City of Cottonwood wastewater treatment plant (WWTP) as a significant TAN source, and required the WWTP to decrease TAN loading by 5% to meet Idaho's TAN ammonia water quality criteria (DEQ, 2000). DEQ then listed the Cottonwood Creek main stem as impaired by ammonia under the Clean Water Act in Idaho's Integrated Report (IR) (IR Category 4a – impaired with an approved TMDL).

In 2002, USEPA issued a National Pollution Discharge Elimination System (NPDES) permit for the City of Cottonwood WWTP (USEPA, 2002). USEPA did not include TAN effluent limits in the permit; USEPA stated "sufficient data are not available to provide a specific wasteload allocation at this time" (USEPA, 2001). The NPDES permit required the City of Cottonwood to

monitor and report TAN concentrations from one effluent sample per month, and included a clause that "allows modification of the permit if results of the monitoring program show a modification is necessary to comply with the state's water quality standards" (USEPA, 2001). When the NPDES permit expired September 30, 2007, USEPA administratively continued it without modification. In July 2018, USEPA granted DEQ authority to regulate discharges from municipal WWTPs under the Idaho Pollution Discharge Elimination System (IPDES) program. Authority for administering the City of Cottonwood WWTP's existing NPDES permit transferred from USEPA to DEQ.

In 2021, DEQ issued a draft IPDES discharge permit for the City of Cottonwood WWTP (permit No. ID0021849) that included TAN effluent limits. The draft permit includes interim effluent limits that must be achieved while the City takes steps to improve its treatment system, and a final effluent limit based on Idaho's current TAN criteria (IDAPA 58.01.02.250.02d) that must be achieved by 2028.

Idaho Code §39-3611 requires DEQ to review existing Idaho TMDLs every 5 years. Since the Cottonwood Creek TMDL was finalized in 2000, multiple changes have occurred, and there is a need to evaluate if, when, and where TAN criteria are exceeded to inform DEQ's TMDL review and IPDES permit processes. Multiple government agencies have monitored TAN concentrations in Cottonwood Creek since 2000, and nearly 300 stream TAN measurements are available. In addition, Idaho's ammonia water quality criteria changed in 2002; the criteria used to develop TMDL concentration target and load requirements no longer apply. TAN concentrations must be compared to the current criteria (IDAPA 58.01.02.250.02d) to evaluate whether Cottonwood Creek is still impaired by TAN. Effluent limits in the 2021 draft IPDES permit are based on the current criteria, but stream monitoring data also need to be compared to current criteria.

If TAN concentrations exceed criteria and the Cottonwood WWTP is the only significant ammonia source, achieving TAN effluent limits included in the draft IPDES permit will likely be critical for achieving TAN criteria. If current TAN criteria are exceeded but there are additional significant sources beyond the WWTP, effluent limits alone may not be sufficient, and additional sources may need to be addressed. If current concentrations do not exceed ammonia criteria, DEQ would propose to delist ammonia as a cause of impairment in Idaho's next (2022) Integrated Report.

2.0 Objectives

The objectives of this report are to:

- Evaluate if ammonia concentrations in main stem Cottonwood Creek segments outside the Nez Perce Reservation boundary currently listed as impaired by ammonia under the Clean Water Act (assessment units ID17060305CL003_02, ID17060305CL003_03, and ID17060305CL003_04) (Figure B1) exceed Idaho's current ammonia water quality criteria.
- Compare total ammonia concentrations and ammonia criteria exceedances upstream and downstream of the Cottonwood WWTP to help evaluate whether the WWTP is the only significant ammonia source.

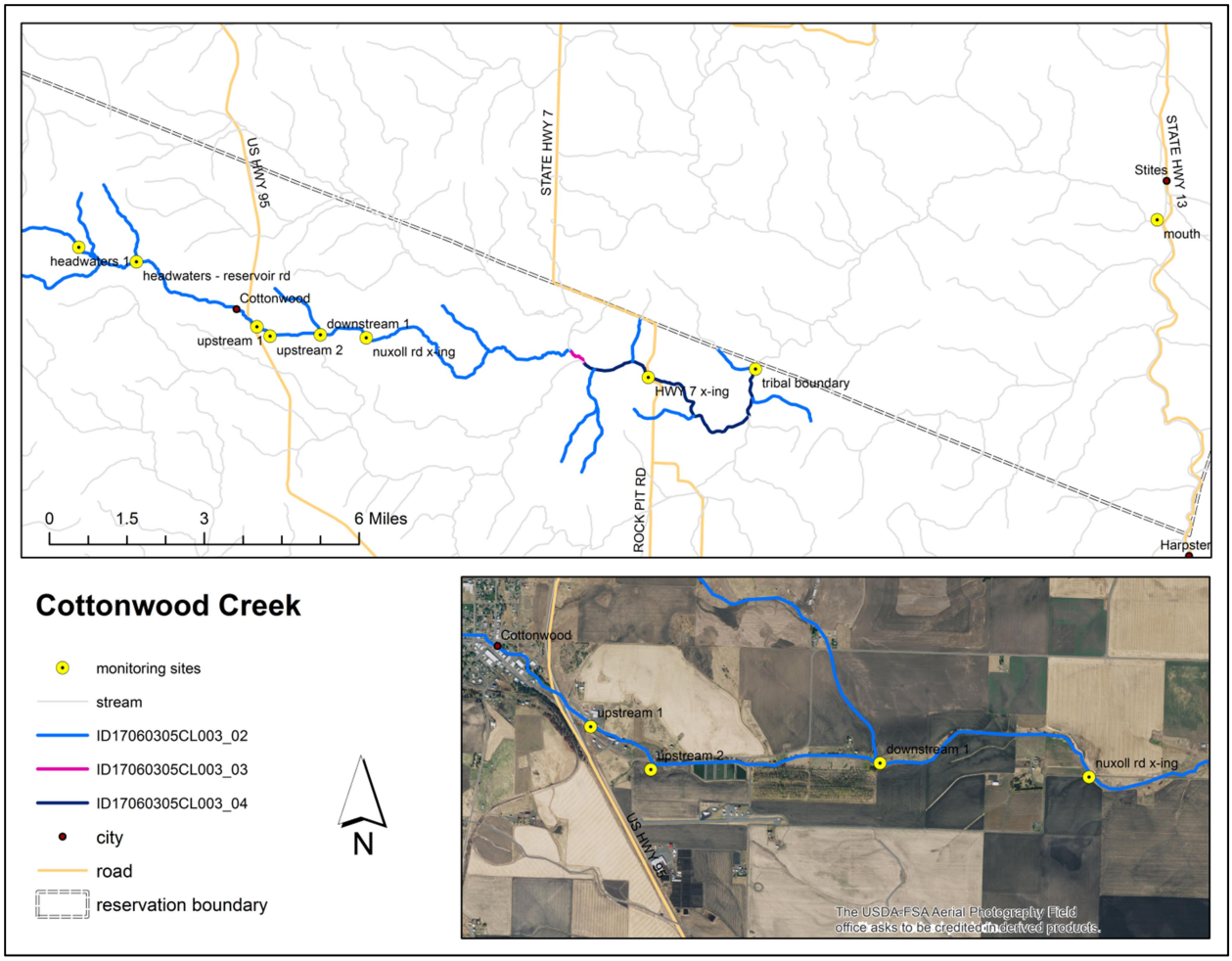

Figure B-1. Cottonwood creek assessment units and monitoring locations. See Table B1 for monitoring location descriptions.

Appendix Table B-1 Monitoring location descriptions. See Table B-2 for data source descriptions.

Site	Latitude	Longitude	Description	Data Sources & Data Years
headwaters 1	46.064484	-116.413814	Headwaters of Cottonwood Cr	Gilmore et al. 2001 (2000-2001)
headwaters – reservoir road	46.06093056	-116.39045	Headwaters at reservoir road crossing	IASCD 2007, NPTWR 2014, NPTWR 2020 (2005-2006, 2011-2012, 2020)
upstream 1	46.0437	-116.34114	Below the City of Cottonwood, above the WWTP	Gilmore et al. 2001 (2000-2001)
upstream 2	46.041179	-116.335724	Upstream of WWTP ponds	DEQ (2019-2021)
downstream 1	46.041979	-116.315501	Immediately below the WWTP 2000-2001 effluent discharge location	Gilmore et al. 2001 (2000-2001)
Nuxoll rd x-ing	46.041505	-116.297013	Nuxoll road crossing, downstream of WWTP	Gilmore et al. 2001, IASCD 2007, NPTWR 2014, NPTWR 2020, DEQ (2000-2001, 2005-2006, 2011-2012, 2019-2021)
HWY 7 x-ing	46.03263	-116.18295	Downstream at HWY 7 crossing	DEQ (2019-2021)
tribal boundary	46.03581	-116.13988	Reservation line road crossing	IASCD 2007, NPTWR 2014, NPTWR 2020, DEQ (2019-2021)
mouth	46.080556	-115.979722	Mouth at Luke's Gulch Road	IADCD 2007, NPTWR 2014

3.0 Methods

3.1 2019-2021 DEQ Monitoring

From October 2019-March 2021 DEQ monitored four sites on the main stem of Cottonwood Creek (Figure B1, Table B1). One site was located upstream of the Cottonwood WWTP ('upstream 2', Figure B1), and three sites were located downstream ('Nuxoll road x-ing', 'HWY 7x-ing, 'tribal boundary, Figure B1). At each site, stream flow, TAN, pH and temperature were measured during each site visit. Samples were collected approximately twice per month between October 2019 and March 2020, and approximately once per week between December 2020 and March 2021.

Stream flow was measured using a Hach FH 950 portable electromagnetic velocity meter and the velocity-area method. A stream transect was established perpendicular to flow. The transect was divided into equal-width cells, with a minimum cell width of 0.5 ft. Within each cell, water depth was recorded, and velocity was measured at 60% of water depth. Cell flow was calculated as the product of cell velocity and area measurements, and total stream flow was calculated by summing cell flows.

TAN was measured using grab water samples collected by submerging a sample bottle below the stream surface. Water samples were preserved with sulfuric acid, placed on ice, and transported to Anatek Labs in Moscow, Idaho. Samples were analyzed using American Public Health Association standard method 4500-NH3G (NEMI 2020).

Field pH and temperature were measured using a Hach Pocket Pro Tester. Prior to each sample event, the pH sensor was either calibrated using a multi-point calibration with standard pH solutions, or a calibration check was performed by submerging the pH sensor into standard pH solution.

Before sampling, DEQ developed a quality assurance project plan (DEQ 2019) and field sampling plan (DEQ 2019, DEQ 2020) documenting planned field and lab methods, quality assurance and quality control (QA/QC) procedures, and data quality objectives. A summary of QA/QC procedures and results is included in Appendix A. One ammonia sample result (1/20/21 at 'upstream 2' site was qualified as an estimate. No sample results were rejected based on QA/QC procedures. All 2019-2021 DEQ monitoring data were considered suitable for evaluating ammonia criteria exceedances.

3.2 2001-2020 External Data

Between 2001 and 2020, the Nez Perce Tribe Water Resources Division (NPTWR), Idaho Association of Soil Conservation Districts (IASCD), and Gilmore et al. 2001 also measured TAN, pH, temperature, and flow in main stem Cottonwood Creek (Figure B1, Table B2). DEQ evaluated methods and quality control information provided by these data sources, and concluded these datasets were suitable for evaluating ammonia criteria exceedances. Flow was measured using the velocity-area method described above, water quality samples were collected using standard methods, and TAN was analyzed using standard laboratory methods (APHA standard method 4500-NH3G or EPA method 350.1) DEQ used both 2019-2021 DEQ data and external data to test for ammonia criteria exceedances as described below.

Appendix Table B-2. External Data Sources

External Data Source	Time Period	Source Description
Gilmore et al. 2001	2000-2001	Monitoring at the Cottonwood Cr headwaters, and above and below the WWTP as part of a regional nutrient study funded by DEQ.
IASCD 2007	2005-2006	IASCD monitored 4 locations on Cottonwood Creek (headwaters, downstream of WWTP, at reservation boundary, at mouth) to evaluate ammonia trends and TMDL compliance.
NPTWR 2014	2011-2012	NPTWR monitored 4 locations on Cottonwood Creek (headwaters, downstream of WWTP, at reservation boundary, at mouth) to evaluate ammonia trends and TMDL compliance.
NPTWR 2021	2020	NPTWR monitored 4 locations on Cottonwood Creek (headwaters, downstream of WWTP, at reservation boundary, at mouth) to evaluate ammonia trends and TMDL compliance.

3.3 Ammonia Criteria Exceedances

Idaho Water Quality Standards include acute and chronic ammonia criteria for protection of aquatic life (IDAPA 58.01.02.250.02d) (Figure B2). The concentrations that must be achieved depend on pH for the acute criterion and on both pH and temperature for the chronic criterion.

The acute criterion requires that the one hour average TAN concentration does not exceed the criterion maximum concentration (CMC) calculated based on pH as shown in Figure 2 more than once during a three year period. To determine if the acute criterion was exceeded, criterion maximum concentration (CMC) values were calculated based on pH and then compared to corresponding TAN results.

The chronic criterion requires that the 30-day average TAN concentration does not exceed the criterion continuous concentration (CCC) calculated based on pH and temperature as shown in Figure 2 more than once every three years. The equation used to calculate CCC values depends on whether fish early life stages are present (Figure B2). To determine if the chronic criterion was exceeded, DEQ calculated CCC values assuming fish early life stages were present. Rolling 30-day arithmetic mean pH and temperature values were used to calculate CCC values. CCC values were then compared to corresponding rolling 30-day arithmetic mean TAN results.

The chronic criterion also requires the highest four day average within a 30-day period does not exceed 2.5 times the CCC. This requirement could not be evaluated because samples were not collected frequently enough to calculate a 4-day average; only one sample was collected within any given 4 day period.

The second order portion of Cottonwood Creek (assessment unit ID17060305CL003_02) is intermittent. DEQ has documented this assessment unit as dry or having no flow during summer on multiple occasions through Beneficial Use Reconnaissance Program (BURP) monitoring and other site visits, including during summer 2019 (DEQ, 2020a). For intermittent streams, numeric criteria for protection of aquatic life only apply when flow exceeds 1 cubic feet per second (cfs) (IDAPA 58.01.02.010.54 and .02.070.06). Therefore, DEQ only evaluated whether acute and chronic criteria were exceeded within ID17060305CL003_02 sites when individual or rolling 30 day mean flows exceeded 1 cfs. The other sampled sites are within stream segments that are perennial (assessment unit ID17060305CL003_04), so ammonia criteria apply at all times, regardless of flow.

d. Ammonia. The following criteria are not to be exceeded dependent upon the temperature, T (degrees C), and pH of the water body: (3-15-02)

i. Acute Criterion (Criterion Maximum Concentration (CMC)). The one (1) hour average concentration of total ammonia nitrogen (in mg N/L) is not to exceed, more than once every three (3) years, the value calculated using the following equation:

$$CMC = \frac{0.275}{1 + 10^{7.204 - pH}} + \frac{39.0}{1 + 10^{pH - 7.204}}$$

(3-15-02)

ii. Chronic Criterion (Criterion Continuous Concentration (CCC)). (3-15-02)

(1) The thirty (30) day average concentration of total ammonia nitrogen (in mg N/L) is not to exceed, more than once every three (3) years, the value calculated using the following equations: (3-15-02)

(a) When fish early life stages are likely present:

$$CCC = \left(\frac{0.0577}{1+10^{7.688-pH}} + \frac{2.487}{1+10^{pH-7.688}}\right) \bullet MIN(2.85, 1.45 \cdot 10^{0.028(25-T)})$$

(3-15-02)

(b) When fish early life stages are likely absent:

$$CCC = \left(\frac{0.0577}{1+10^{7.688-pH}} + \frac{2.487}{1+10^{pH-7.688}}\right) \bullet 1.45 \cdot 10^{0.028(25-T)})$$

(3-15-02)

(2) The highest four-day (4) average within the thirty-day (30) period should not exceed two point five (2.5) times the CCC. (3-15-02)

(3) Because the Department presumes that many waters in the state may have both spring-spawning and fall-spawning species of fish present, early life stages of fish may be present throughout much of the year. Accordingly, the Department will apply the CCC for when fish early life stages are present at all times of the year unless: (3-15-02)

(a) Time frames during the year are identified when early life stages are unlikely to be present, and (3-15-02)

(b) The Department is provided all readily available information supporting this finding such as the fish species distributions, spawning periods, nursery periods, and the duration of early life stages found in the water body; and (3-15-02)

(c) The Department determines early life stages are likely absent. (3-15-02)

Figure B-2. Idaho Ammonia water quality standards (IDAPA 58.01.02.250.02d).

4.0 Results

4.1 Criteria Exceedances

The acute and chronic criteria were exceeded downstream of the City of Cottonwood WWTP where Cottonwood Creek crosses Nuxoll Road. Criteria were not exceeded upstream of the WWTP, or at sites further downstream (at the HWY 7 crossing, at the reservation boundary, at the mouth). All water quality data and criteria exceedance results are included in publically available supplemental materials at osf.io/gmvh4, DOI 10.17605/OSF.IO/GMVH4.

TAN concentrations at the Nuxoll Road crossing site ranged from 0.01-7.37 mg N/L, with peaks during winter (Figure 3-4). Stream flow is intermittent at the Nuxoll road crossing site, so ammonia criteria only apply when flow exceeds 1 cfs (IDAPA 58.01.02.010.54 and .02.070.06). Flows exceeded 1 cfs and TAN exceeded acute criterion CMC values at the Nuxoll Road crossing on 1/15/2020 and 2/25/2001. However, the acute criterion was not exceeded because there was only one CMC exceedance during a three year period.

Rolling 30 day mean flow exceeded 1 cfs and rolling 30 day mean TAN exceeded chronic criterion CCC values multiple times at this site in each of 2001, 2005, 2006, 2012, 2020, and 2021. All CCC exceedances occurred during months of January, February, or March. Because CCC values were exceeded when flows exceeded 1 cfs at the Nuxoll Road site, Idaho's ammonia criteria were not achieved within assessment unit ID17060305CL003_02. In Idaho's next (2022) Integrated Report, DEQ will retain ammonia as a cause of impairment for this assessment unit (Category 4a – impaired with approved TMDL).

No data were available within ID17060305CL003_03. This assessment unit is a 0.4 mile long stream segment located entirely within private property (Figure B-1). The property owner did not respond to DEQ requests for property access. ID17060305CL003_03 will remain listed as impaired by ammonia in Idaho's Integrated Report until data can be collected within this assessment unit.

Further downstream, a total of 83 TAN samples were collected across two sites (HWY 7 crossing, reservation boundary) within assessment unit ID17060305CL003_04 during 2005-2021. TAN results at these sites ranged from 0.01-0.83 mg N/L and no results exceeded CMC or CCC values. Idaho's ammonia criteria therefore were achieved within this assessment unit, and DEQ will propose to delist ammonia as a cause of impairment within ID17060305CL003_04 in Idaho's 2022 Integrated Report.

Nez Perce Tribe Water Resources Division collected 34 TAN samples at the Cottonwood Creek mouth between 2005 and 2012. TAN concentrations ranged 0.01-0.79 mg N/L, and no results exceeded CMC or CCC values. The mouth of Cottonwood Creek falls within the Nez Perce Reservation boundary. Nez Perce Tribe and USEPA are responsible for assessing whether applicable water quality criteria are achieved and beneficial uses are supported within the reservation boundary, per Idaho's tribal waters policy (DEQ, 2020a). In Idaho's Integrated Report, DEQ categorizes all waters within reservation boundaries as unassessed.

Within ID17060305CL003_02, there were 7 sample events where TAN exceeded the CMC but stream flow was less than 1 cfs, so numeric criteria for protection of aquatic life do not apply (IDAPA 58.01.02.010.54 and .070.06). There were also 7 cases where rolling 30 day mean concentrations exceeded CCC, but rolling 30 day mean flow was less than 1 cfs, so numeric criteria for protection of aquatic life do not apply. Stream flow patterns at each monitoring site are presented in Figure B-5.

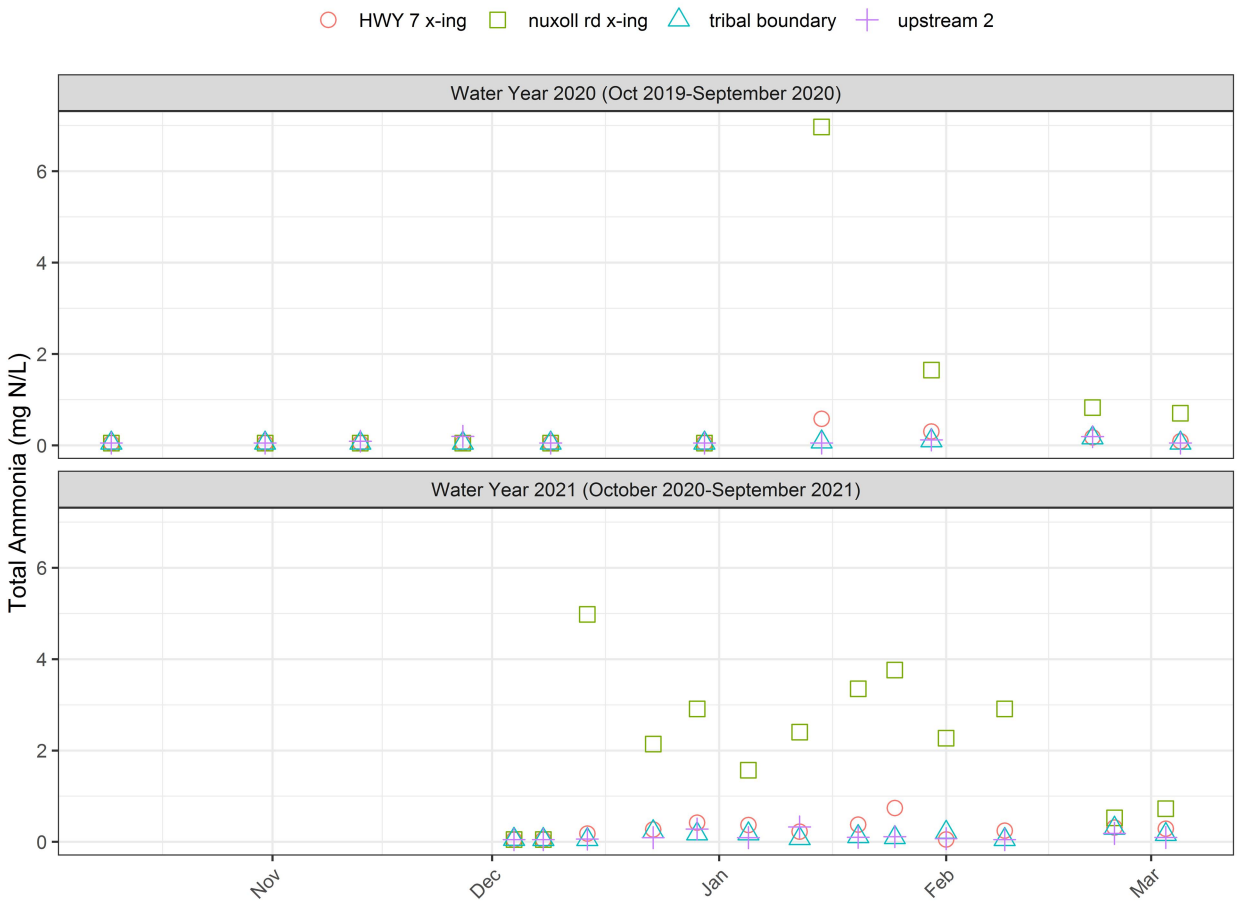

Figure B-3. Total ammonia nitrogen (TAN) concentrations during 2019-2021 DEQ monitoring.

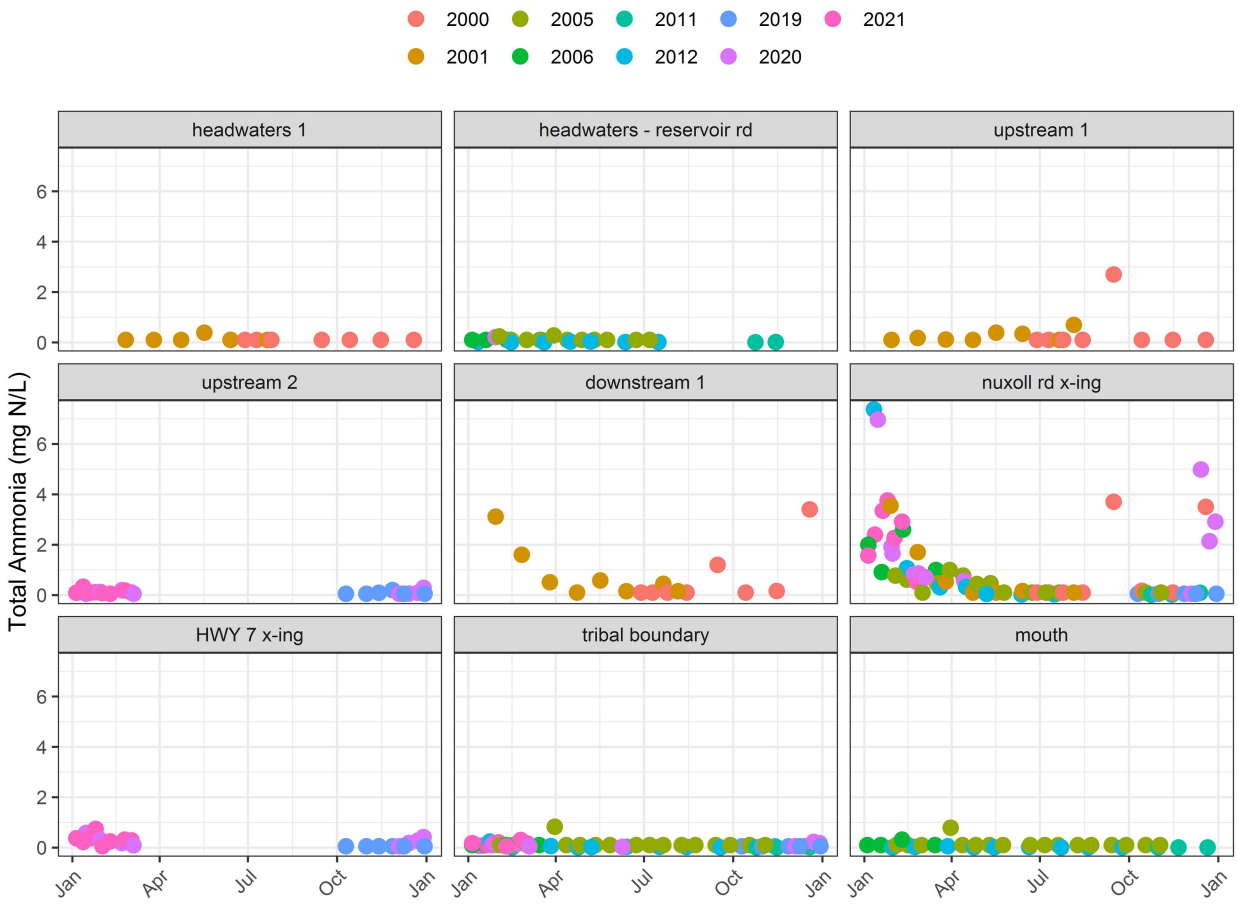

Figure B-4. Main stem Cottonwood Creek total ammonia nitrogen (TAN) concentrations 2000-2021.

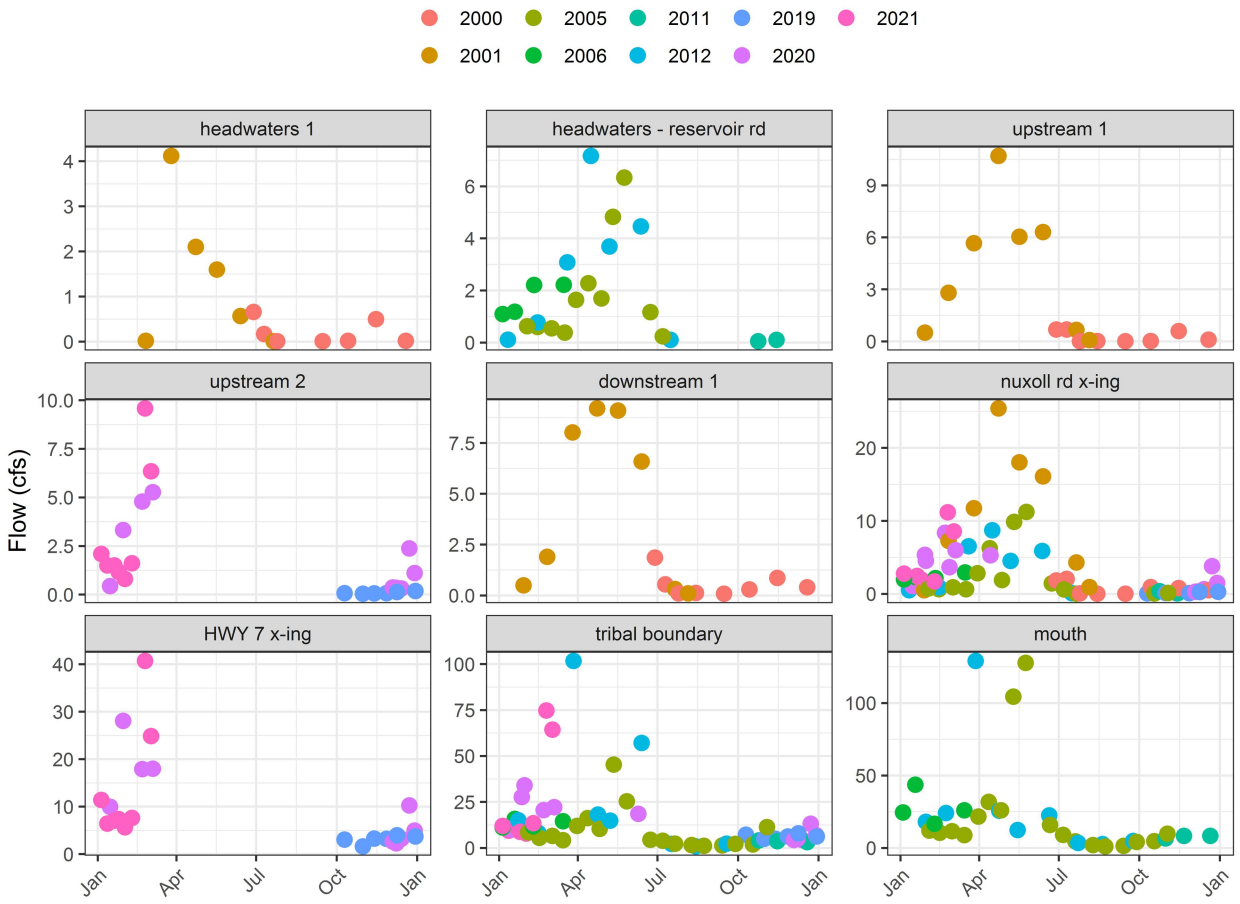

Figure B-5. Stream flow measured at Figure 1 monitoring sites 2000-2020. Headwaters, upstream, downstream, and nuxoll road x-ing sites are within ID17060305CL03_02. HWY 7 x-ing, tribal boundary, and mouth sites are within ID17060305CL03_04.

4.2 Comparison of Concentrations Upstream and Downstream of the WWTP

During time periods the WWTP discharged, TAN concentrations were higher downstream of the WWTP at the Nuxoll Road crossing compared to upstream of the WWTP (Figure 3-4). At the Nuxoll Road crossing site, TAN concentrations were similar to those upstream during April-November when the WWTP was not discharging, but increased substantially December-March when the WWTP discharged (Figure B-4). During 2019-2021, TAN concentration peaks at the Nuxoll Road site occurred shortly after the WWTP began discharging. The city reported it discharged January 2020 – March 2020, and December-March 2021. The city measured effluent TAN concentrations once per month during these discharge periods, and reported effluent TAN concentrations were 16.5 mg N/L in January 2020, 9.24 mg N/L in February 2020, 6.61 mg N/L in March 2020, 15.8 mg N/L in December 2020, 14.0 mg N/L in January 2021, and 1.59 mg N/L in February 2021. These effluent TAN concentrations were much higher than TAN concentrations observed upstream of the WWTP during the same period (Figures 3-4). Upstream of the WWTP, 52 of 86 samples had TAN concentrations below the laboratory reporting limit, and all but 2 samples had concentrations < 0.4 mg N/L. The WWTP therefore appears to be the primary TAN source to Cottonwood Creek.

5.0 Data Availability

Water quality data used for analyses in this report are available through an Open Science Framework web page: *osf.io/gmvh4*, DOI 10.17605/OSF.IO/GMVH4. Supplemental materials included on the web page include water quality data, R software code used to test for criteria exceedances and create figures 3-5, a comma separated values (.csv) file with criteria exceedance results, a data dictionary, shapefiles used to create Figure 1, and report documents associated with external data sources (Table B-2). DEQ 2019-2021 data described in this report are also available through Water Quality Portal (*https://www.waterqualitydata.us*/).

6.0 References

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Appendix 1 Quality Assurance/Quality Control

This appendix quality assurance/quality control (QA/QC) procedures associated with DEQ 2019-2021 monitoring and evaluates if data quality objectives and criteria were met. Before sampling, DEQ developed a quality assurance project plan (QAPP) (DEQ, 2019) and field sampling plan (DEQ, 2020) documenting planned field and lab methods, quality assurance and quality control (QA/QC) procedures, and data quality objectives. These documents specified data quality requirements for precision, accuracy, sample preservation and holding time, measurement range, representativeness, comparability, and completeness.

Precision

Precision is a measure of agreement between two measurements of the same parameter under prescribed conditions. Overall precision was evaluated by calculating the relative percent difference (RPD) of field duplicate samples (equation 1). The project required one field duplicate TAN sample to be collected for every 20 regular TAN samples collected (5% field duplicate frequency). This requirement was met; 92 regular TAN samples were collected and 5 TAN field duplicate samples were collected (5.4% field duplicate frequency). The project QAPP specified a RPD goal of +/-25% for low-level concentrations (< 20 x laboratory reporting limit) and 10% for high level concentrations (> 20 x laboratory reporting limit).

$$RPD = \frac{(C_1 - C_2)}{(C_1 + C_2)/2} \times 100$$

Equation 1. Relative percent difference (RPD).

Where: C_1 = concentration in first sample

C_2 = concentration in the second or duplicate sample

Where both C_1 and C_2 > 5 times the laboratory method detection limit (MDL)

Where one or both C_1 and C_2 are < 5 times the MDL, the results will be considered within control limits where C_1 and C_2 are ± MDL.

Table 1B. Total ammonia nitrogen field duplicate relative percent difference (RPD) results.

Site	Date	C1 (mg N/L)	C2 (mg N/L)	RPD (%)
2019LEWSC3_02u	10/10/2019	ND	ND	--
2019LEWSC3_02u	12/9/2019	ND	ND	--
2019LEWSC3_04	2/21/2020	0.139	0.164	-16.5%
2019LEWSC3_02u	12/14/2020	ND	0.0612	-20.1%
2019LEWSC3_02u	1/20/2021	ND	0.101	-67.5%

ND = not detected at practical quantitation limit of 0.05 mg N/L; for ND results, a value of 0.05 was used to calculate RPD.

RPD values met project goals except for one field duplicate pair collected 1/20/2021 (Table 1B). RPD values for field duplicate pairs with concentrations at or near detection limits can be large and not representative of RPD values for higher-concentration field duplicate pairs. In addition, TAN concentrations greatly exceeded CMC and CCC values during 2019-2021, and TAN precision magnitudes would not affect conclusions about whether or not criteria were exceeded. For these reasons, no data were qualified or rejected based on the 1/20/2021 RPD result.

Accuracy

Accuracy is a measure of the agreement between a known "true" reference value and the associated measured value. Analytical laboratories evaluated laboratory accuracy based on laboratory control samples or matrix spike samples as required by associated analytical methods. Because laboratories did not qualify any results due to laboratory control or matrix spike samples, DEQ assumed laboratory accuracy requirements were met.

To evaluate overall accuracy, DEQ collected field blank samples. Field blank samples were collected by pouring deionized water into sample bottles in the field, and then submitting the samples to the laboratory for analysis. These samples help evaluate whether sampling and analytical procedures cause sample contamination or affect overall accuracy. The project QAPP required one field blank sample to be collected for every 20 regular TAN samples collected (5% field duplicate frequency). This requirement was met; 92 regular TAN samples were collected and 5 TAN field blank samples were collected (5.4% field duplicate frequency). All field blank samples had TAN concentrations less than the laboratory practical quantitation limit (0.05 mg N/L) and met project data quality goals.

Sample Preservation and Holding Time

TAN sample preservation and holding time requirements were set by the analytical laboratory based on TAN analytical methods (standard method 4500-NH3G (NEMI, 2020)). The QAPP required TAN samples to be preserved with sulfuric acid (H_2SO_4) and analyzed within 28 days of collection. All samples were collected in bottles provided by the laboratory that were pre-preserved with H2SO4, and the laboratory analyzed all samples within the required holding time.

Data Representativeness

Data representativeness is the degree to which sample data accurately and precisely represent site conditions. Representativeness is best satisfied by confirming that sampling locations are properly selected, sample collection procedures are appropriate and consistently followed, a sufficient number of samples are collected given the variability of the data, and analytical results meet data quality objectives. Because field sampling and analysis followed standard procedures, procedures were consistent with those in external datasets, accuracy and precision requirements were met, and there were no issues with laboratory QA review, all project data satisfied representativeness requirements.

Data Comparability

Comparability is the confidence that one data set can be compared to another data set. The project QAPP did not provide specific comparability criteria, but provided general guidelines for evaluating comparability. Because standard sampling and laboratory procedures were followed, procedures were consistent with those in external datasets, and no significant issues were identified during data verification and validation, all project data satisfied data comparability requirements.

Data Completeness

Data completeness is the percentage of valid data relative to the total possible valid data points. The QAPP defined a completeness objective of 80%. No samples were rejected, so project completeness was 100%, and the project completeness goal was met.